Advisability of Increasing Present Steam Pressures—Consideration That Should Be Given Motor Speed, Torque and Power in Machine Tool Work—and Other Articles

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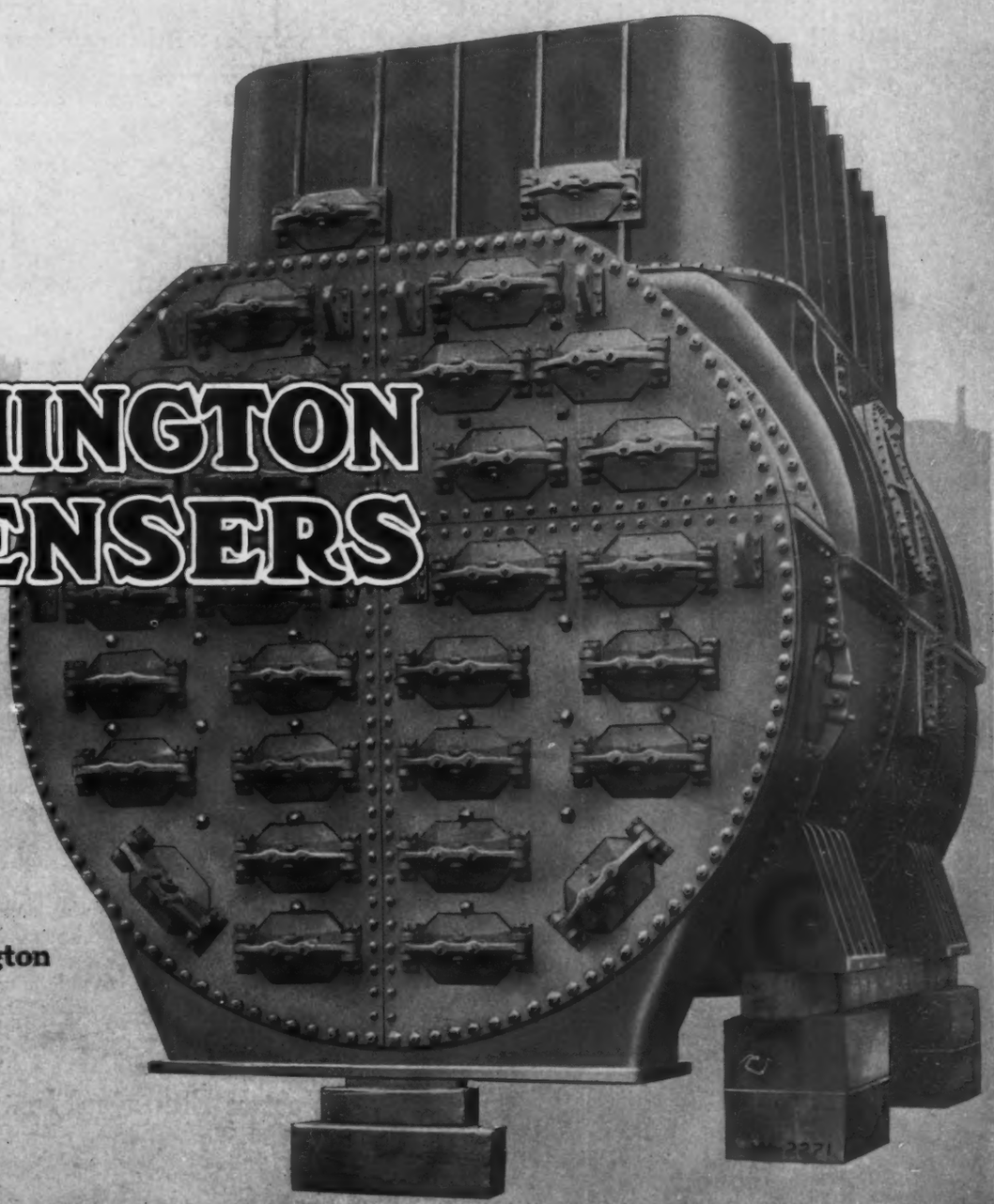

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The Lesson of Lost Water Power

THE war is burning deeply into national consciousness a conviction of the supreme value of power and the sources of power. Blazoned before the public so that he who runs may read is the lesson of lost energy. From bitter experience with coal shortage the public has learned the folly of our uneconomical policy regarding water powers. Our people know better than they did what useful water powers mean not only in coal saving but in conserving labor and transportation facilities, and they are demanding action by Congress—action that shall stop waste, action that shall harness resources of nature now going playfully to the seas while industries close down for lack of power. It is an emergency that we have to meet; legislation now will not save us from coal shortage this winter, but it will give us provident use of great resources for the future. For the public good Congress should act; it will find that any legislation permitting development on fair terms will protect our diminishing fuel reserves and conserve labor and railway equipment.

The Fruits of Co-operation

AS USERS and makers of electrical apparatus, our readers will be interested in the address of Clarence L. Collens, II, president of the Electric Power Club which embraces nearly all of the manufacturers of motors, transformers and controllers in this country. Rarely is occasion given for one branch of industry to know what is in the mind of some other branch, and especially in the minds of the manufacturers. We draw attention to this because it is a good omen. When an organization is animated with the desire to promote the best interests of the entire industry whole-heartedly and without reserve, it shows evidences of greatness and should be encouraged in its work. This accounts for the phenomenal growth of the Electric Power Club and for the excellent results it has been able to obtain in standardization. The Power Club now seeks to expand and develop. The leaven of co-operation has worked, and the membership recognizes in a large way that as the entire industry prospers each branch necessarily benefits. This is but the reaffirmation of the old proverb, "There is that scattereth and yet increaseth, and there is that withholdeth more than is meet; but it tendeth to poverty." The Electric Power Club does not withhold; it has given liberally of its time and thought, first in getting itself ready for co-operation and then in extending it to the other branches of the electrical industry, to the national government and to the ultimate consumer. We need more of this spirit in the industry—fewer self-seekers and more co-operators.

Service Extensions

BESET by the difficulty of getting funds on one hand and by the high cost of material on the other, managers of central station properties naturally are not making any circuit extensions the income from which is insufficient to meet the fixed charges on the investment. Willingness to serve is, however, not lacking, merely the wherewithal. It is generally recognized that as the resources of the country are devoted more and more to the prosecution of the war conservation of men, money and material becomes imperative. As a policy this is both desirable and consistent with public interest, but until it is established by some central authority it will not be generally observed. It is evident from recent findings and discussions that there is no agreement among the various public service commissions on this matter; possibly the laws in the separate states are such that none can be had. However, there is no virtue in uncertainty, and, inasmuch as this question of making extensions has already arisen and bids fair to come up more frequently, it would be well if utilities and commissions would come to some definite understanding quickly. The Massachusetts commission has already expressed itself on war-time restrictions and service expenditures in the case of the New England Telephone & Telegraph Company. Ohio central station managers have discussed service extensions, and we give in this issue some sidelights on the question by one of the engineers connected with the California Railroad Commission. There is no trouble with the theory or difficulty in determining who shall make the investment; the trouble is that the theory is offset by the cold fact that one cannot get the material or raise the money with which to carry on the work.

Private and Public Lighting

ONE effect of the recent agitation against electric signs is being found in the realization that signs and display lighting have been no inconsiderable factor in proper illumination of city streets. Their use has been so gradual that their full effect is realized only by those who have given particular attention to the technique of street lighting. Now that these private auxiliaries to the public efforts are to a very considerable extent "down and out," their real importance has come to the fore. The result has been a striking amount of

discussion regarding the new necessities of lighting streets, squares and public places which have sunk into comparative darkness. Private enterprise in "whiteway" lighting is familiar enough and has been an accepted part of the lighting scheme of a good many cities, particularly of the smaller sort. The window and sign lighting, however, which has attracted less notice, has been far from negligible in its results, and its absence is going to be generally noticed. The net effect is likely to be a material increase in the public lighting necessary for general purposes of usefulness in a good many streets, not universally, but wherever the public has become accustomed to a degree of illumination now absent. The ultimate result doubtless will tend to the conservation of fuel, because well-placed street lights are more efficient for their particular purpose than signs and windows. The man in the street, however, will certainly look askance at a general reduction of illumination, and city authorities will do well to follow up this suggestion and judiciously to add to or rearrange their street-lighting program to meet the requirements which have arisen.

Higher Steam Pressures

THOSE of our readers who are practically interested in the efficiency of steam production will find much to think about in J. T. Foster's article on high steam pressures. The tendency toward increasing pressure and increasing superheat as well has been very marked in the last decade, probably on account of the wider use of the steam turbine. Mr. Foster, however, goes further into the matter than has been usual in such discussions, and considers the increase in efficiencies, both thermal and with respect to the water rate, up to pressures on a far higher plane than those now customarily used. It has been a long road from a few pounds per square inch pressure obtained from a tank boiler to the water-tube boilers at 200 lb. or 250 lb. (14 kg. or 17.5 kg. per sq. cm.) pressure of the present day. If, however, there is genuine economy, including all things, in doubling any pressures now customarily used, that economy must sooner or later be sought.

To-day our standard boilers and piping belong to the region of 200 lb. or 250 lb. per square inch (14 kg. or 17.5 kg. per sq. cm.) pressure. Anything beyond this would be rated as highly special and frowned upon accordingly. In the stress of war we probably have not time to go into the development of apparatus of unusual and extraordinary properties, but it is well to look forward and to forecast the gains which may be made in the future. In Mr. Foster's judgment 500 lb. or 600 lb. per square inch (35 kg. or 42 kg. per sq. cm.) is not outside the reasonable economic situation, there being promise of economy sufficient to outweigh the added charges against equipment. These figures look big for the moment, and they may or may not be reached in general practice, but it is reasonably certain that both higher pressures and higher superheats than are now employed are within easy sight.

The Unshaken Preferred Borrower

IN ORDER that the expansion of the electrical industry may proceed in a normal, orderly way it is to be earnestly hoped that the arrest in the decline of security prices is permanent. The rock foundation of the industry is the operating central station. That is the substantial property whose welfare and continued growth in response to public demand for service furnish the motive power for all other branches of the industry. Its economic value to the community rests not alone on splendid past performance but on the instant readiness to meet all legitimate calls for service, to go the limit in caring for the electrical needs of the community. The performance of its unquestioned large obligation to the community is, however, rigidly dependent upon its ability to market securities at fair interest cost. It cannot continue to meet its obligation with existing plant investment alone, for the steady growth in volume of business necessitates corresponding steady growth in generating and distribution facilities.

We have seen a tumultuous market in stocks and bonds, with fear, rampant and vicious speculation, anxiety over war taxes, increasing credit tightness, international influences of varying importance. Through it all there is the increasing, insistent demand for more power for industry, for every kilowatt-hour that the plants can produce. We have blackness in the investment market, loud cries from consumers for more and more energy from the production department, bankers unable or unwilling to float securities except at discouraging cost, customers closing plants or curtailing output to cut down the load on the peak. The thing is an anomaly; it cannot last. Industry of intrinsic soundness and of indispensable character is bound to get recognition and protection.

It is not our function to record day-to-day fluctuations in security prices; it is our function to discuss great movements in security values when they touch, as this one does, the throbbing heart of central station growth, its ability to meet and anticipate demands for service. In these times there is sharp scrutiny by bankers to determine what are essential and what are nonessential industries. In Washington, the nerve center of business for the duration of the war, the public utility has been judged by standards applied by keen-minded public servants with the authority of autocrats. In their sharp eyes the public utility ranks among those at the top.

If the frank attitude of the Washington authorities means anything—and we are confident that from their deliberate position there will be no serious recession during war—it means that public utilities will receive every possible consideration. When the need of the central station is urgent we have an unshakable belief that it will have a fair chance at the guarded reservoirs of capital. While we shall have in effect if not in reality a capital administrator, just as we have a Fuel Administrator and a Food Administrator, the electric central station as an institution is a vital part of the community body; it cannot be severed if real life and

vitality are to course through the arteries of commerce. Its standing as the signer of notes is a high one. Market values may be borne down by the weight of general conditions, but real values are unshaken, and in time they will help the electric companies to their old preferred position as borrowers.

Unsymmetrically Spaced Conductors

IT IS well known that a three-phase system of line conductors may be regarded as equivalent to a combination of three independent single-phase lines, each carrying a star-branch load, and a neutral or zero-potential return path of negligible impedance. The three single-phase branches act as though provided with a perfect ground return. If the generator impresses a symmetrical three-phase voltage on the system at the sending end; if, moreover, the load is symmetrically applied at the receiving end, and finally if the three conductors are uniform, symmetrical and symmetrically spaced, then the three-phase system is a perfectly balanced system, whatever its power factor may be, and the three component single-phase systems into which it may be theoretically analyzed are identical, except as to phases.

In practice the preceding ideal conditions are always departed from to some extent and are sometimes departed from greatly. The load applied to the system is ordinarily dissymmetrical, the currents demanded from the generator are dissymmetrical, and the generator in turn delivers unbalanced voltages at the sending end. Moreover, the three line conductors are ordinarily disposed dissymmetrically on the poles, thereby introducing dissymmetries in the line potential drops, so that unbalanced systems may be said to constitute the rule and balanced systems the exception. A certain degree of unbalance in the magnitudes or in the phases of the delivered voltages or the delivered currents may be disregarded as insignificant; but beyond this limit, which depends on the nature of the service, unbalance becomes a serious detriment to good operation.

The article this week by George S. Humphrey takes up this important question of unbalance as affected by line dissymmetry. There are several ways in which the problem can be attacked. The way selected in this article is to treat each wire as having a definite resistance and reactance for each of the three loops of a three-wire system, and to analyze each line current into its loop components, so as to obtain resultant vector voltage drops. Some very practical conclusions are thereby deduced, which, while they may not all be new, are certainly not generally known. One deduction in particular is that when the three untransposed line wires lie on the same cross-arm, at equal horizontal separating distances, the virtual effect is to alter the linear resistances of the outer wires, that of one outer being increased and that of the other outer as much decreased. Moreover, the outer linear reactances are equal, and greater than the linear reactance of the middle wire. The virtual change in linear resistance of the outers is independent of the size of wire or of their horizontal spacing on the cross-arm. The article deserves the careful attention of transmission-line students.

Engineering Research and Publicity

THE last annual report of the British Privy Council's committee for scientific and industrial research deserves careful consideration in many respects, especially as showing a much closer unification and co-ordination of effort among the various research agencies than has been achieved in this country. The activities recorded deal not only with war necessities but with the intensive post-bellum period of co-operation within the empire and competition without. Government agencies, technical societies, various manufacturers' associations and institutions of learning are all brought under the guidance of a single committee, to which the imposing sum of £1,000,000 has been allowed by Parliament. It is not to be denied that in some respects this country is ahead of England in research, especially in the magnificent equipment of the research laboratories of large manufacturing concerns. As a matter of fact, the very first issue of the British committee's papers bearing on industrial research is devoted to industrial research in the United States, and its author paints a glowing picture of research facilities available in this country. Nevertheless, the British have accomplished a wonderful amount of organization within the brief period of two years and under the most trying war conditions. It is to be hoped that our Council for National Defense and its Research Council will publish a similar report before long and that they will be able to show similar results. In particular we are anxious to know how far they have succeeded in drawing into their work the national engineering societies, the principal industrial associations and institutions of learning. Some of the council's work is confidential in its nature, but a great deal can be given professional publicity following the praiseworthy example set by the British committee.

The Coming Issues

VARNISHED cambric is used in so many places for insulation that the paper to be presented in next week's issue on "Apparent Dielectric Strength of Varnished Cambric" should be of interest to practically all electrical engineers. The information represents about three years' co-operative work between the Electrical Testing Laboratories of New York and Drs. A. E. Kennelly and R. J. Wiseman. Another article which will be presented in the next issue of the ELECTRICAL WORLD will dwell on the characteristics of different types of motors and the industrial applications to which they are adapted.

Advisability of Higher Steam Pressures

Discussion of the Question of Increasing Present Steam Pressures, with an Estimate of the Increased Cost of Equipment—Curves Showing Improvement in Water Rates and Thermal Efficiencies

BY J. T. FOSTER

SINCE there is no reason to believe that central station operating expenses will decrease appreciably in the near future, the question of increasing steam pressures should be of more than academic interest. At the time the subject was first brought prominently before the engineering world in 1915 there seems to have been some doubt as to whether it would be practicable to attempt a gain in thermal efficiency by increasing pressures much above those now in use. Since that time, however, it appears that considerable thought has been given to the subject, and a number of prominent engineers have expressed the view that high pressures are not only feasible but inevitable.

WATER RATES IMPORTANT

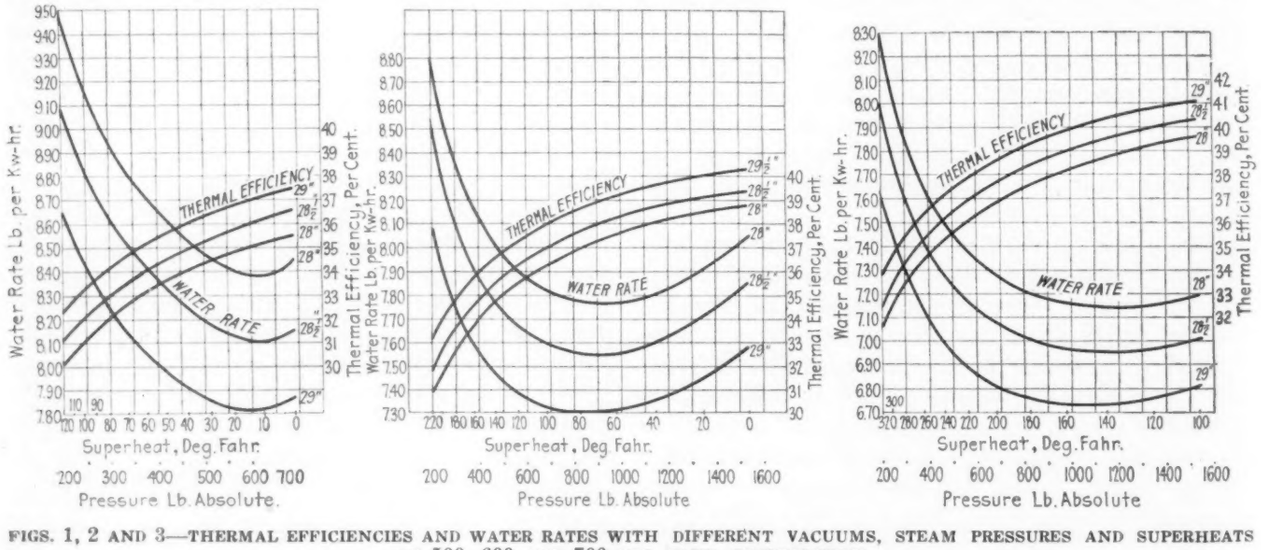
Previous discussions of this subject have been confined to thermal efficiencies, but a consideration of water rates is probably of more interest to the average engineer and in addition brings out some points not apparent from an examination of the thermal-efficiency curves. The points plotted in the accompanying curves are calculated from Goodenough's formulas, published in Bulletin No. 75 of the Engineering Experiment Station of the University of Illinois.

Fig. 1 shows thermal efficiencies and water rates on the basis of a constant boiler temperature of 500 deg. Fahr. (260 deg. C.) and for vacuums of 28, 28½ and 29 in. (71.2, 72.5 and 73.7 cm.). The superheat, of course, decreases with increasing pressure, the dry and saturated condition being reached in this case at approximately 680 lb. (47.6 kg.).

Similar information is plotted in Fig. 2 for a boiler temperature constant at 600 deg. Fahr. (310 deg. C.). In this case saturation is not reached until the pressure reaches approximately 1550 lb. (108.5 kg.). It will be seen that under these conditions the water-rate curve drops to a minimum in the region between 800 lb. (56 kg.) and 1000 lb. (70.3 kg.) pressure, and that from 800 lb. on the thermal efficiency increments become less and less.

With a boiler temperature of 700 deg. Fahr. (370 deg. C.) the conditions are as shown in Fig. 3. Since the steam is still superheated 100 deg. Fahr. (37.7 deg. C.) at 1550 lb. (108.5 kg.) pressure, it would be possible to plot additional points up to approximately 3000 lb. (210 kg.) without running into the region of wet steam. However, very little additional information would be gained from carrying the calculation any further, as will be seen from an examination of Table I. As shown in this table, the thermal efficiency increments per 100 lb. (7 kg.) increase in pressure above 1100 lb. (77 kg.) are very small, while the water rate increases quite rapidly.

For the purpose of comparing thermal efficiencies and water rates at a vacuum of 28½ in. at the exhaust and boiler temperatures of 500 deg., 600 deg. and 700 deg. Fahr., parts of Figs. 1, 2 and 3 are replotted in Fig. 4. Taking all the factors into consideration, it would appear that the most economical point would be at that pressure and temperature at which the water rate is lowest. This point would be at a pressure of 1100 lb. (77 kg.) and a temperature of 700 deg. Fahr. (370 deg. C.). It is not to be expected, however, that an attempt will be made to reach this condition at once. It is more probable that the increases will be made in 100-lb. or 200-lb. (7-kg. and 14-kg.) increments and that progress toward the very high pressures will be based on accumulated knowledge.



FIGS. 1, 2 AND 3—THERMAL EFFICIENCIES AND WATER RATES WITH DIFFERENT VACUUMS, STEAM PRESSURES AND SUPERHEATS AT 500, 600 AND 700 DEG. FAHR. RESPECTIVELY

The cost of equipment for operation at high pressures will, of course, be greater than the cost of equip-

ment for 200-lb. (14-kg.) pressure. While there is no accurate data as to probable costs when the pressure is as high as 1000 lb. (70.3 kg.), it has been possible to obtain data on which the percentages given in Table II are based.

It should be borne in mind that the figures in Table II, which may seem small, are percentages of the total

TABLE I—RANKINE-CYCLE WATER RATES AND THERMAL EFFICIENCIES AT CONSTANT STEAM TEMPERATURE OF 700 DEG. FAHR. (370 DEG. C.) AND VACUUM OF 28½ IN. (72.5 CM.) WITH DIFFERENT STEAM PRESSURES

Pressure (Lb.)	Rankine-Cycle Water Rate (Lb.)	Thermal Efficiency (Per Cent)
1100	6.96	39.3
1200	6.96	39.6
1300	6.96	39.8
1400	6.97	40.0
1500	7.00	40.2
1600	7.03	40.4
1700	7.07	40.6
1800	7.10	40.8
1900	7.16	40.8
2000	7.22	40.8

cost of the plant, which cost includes foundations, structural steel, brick work switching equipment, bus and cell work and numerous other items whose cost will be fixed regardless of the operating pressure.

STRUCTURAL CONSIDERATIONS

Practical considerations seem to offer no insuperable difficulties. The materials now in use for piping with steam at 200 lb. (14 kg.) pressure should have ample strength to withstand higher pressures and temperatures, but welded joints would undoubtedly be necessary. Engineers experienced in the design of boilers and turbines have expressed the view that, while a

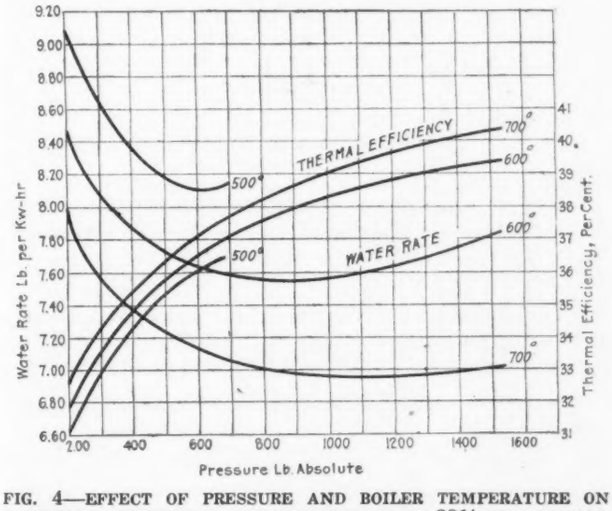


FIG. 4—EFFECT OF PRESSURE AND BOILER TEMPERATURE ON THERMAL EFFICIENCY AND WATER RATE AT 28½-IN. VACUUM

certain amount of redesign will be necessary, the changes in the case of 500-lb. or 600-lb. (35-kg. or 42-kg.) operating pressures are not radical, and that as soon as there is sufficient demand the work of developing high-pressure apparatus will be undertaken.

The main turbine for higher pressure will probably be a two-unit or three-unit combination so as to avoid setting up excessive strains within a single casing. In such a case a breakdown of the high-pressure unit would probably make it difficult to operate the low-pressure end except through a reducer. As for economizers, no change will be necessary because it will be possible to operate under exactly the same conditions as at present. This can be accomplished by pumping

TABLE II—PER CENT* INCREASE IN TOTAL COST OF PLANT WITH ADOPTION OF DIFFERENT PRESSURES

Item	Pressure (Lb.)			
	300	400	500	600
Boilers	0.75	1.50	2.20	2.90
Turbines	1.40	1.40	1.40	1.40
Condensers	−0.20	−0.40	−0.50	−0.60
Economizers	0.00	0.00	0.00	0.00
Piping	0.50	0.90	1.30	1.70
Total percentage increase	2.45	3.40	4.40	5.40

*Referred to 200 lb. as a datum.

water to the economizers at the usual pressure and stepping up the pressure between the economizers and boiler to 500 lb. or 600 lb. (35 kg. or 42 kg.).

The operation of steam-driven auxiliary equipment could be accomplished by one of the following methods: (1) Using equipment designed as at present, operating on steam bled from the main turbine; (2) using equipment designed as at present, supplied from the high-pressure mains through a reducing valve; (3) using uniflow engines, which it is claimed are more economical at high pressures than small turbines of the same horsepower rating.

There appears to be no reasons why the gains indicated in the curves should not be realized to a large extent. The change from 200 lb. to 500 lb. or 600 lb. is no more revolutionary than the change which was made at the time standard practice raised the pressure from 80 lb. (5.6 kg.) to 200 lb. (14 kg.) or more. In view of the fact that the earlier change netted a gain of approximately 20 per cent, the expected gain in economy from the change to 500 lb. or 600 lb. does not seem excessive.

Chicago an Example for England

A writer in the *Westminster Gazette*, commending as an example the system of the Commonwealth Edison Company of Chicago and associated Insull properties, says that the solution of the existing state of things in England lies in: "(1) The establishment of a number of central station systems, themselves all linked up, and the installation of a comparatively few huge generating plants in convenient localities. (2) These plants should be established as nearly at the coal mine mouth as possible. (3) The plants should be hydroelectric wherever it is possible to assemble a sufficient volume of water with a fair drop to be worth while. The case of an artificial lake formed at Gatun, on the Panama Canal, with a drop of 85 ft., is to the point, since it may be advanced that there are no great powers available in the British Isles. (4) The determination and decision to scrap a very great number of existing plants. This is not so severe as might appear, as the life or use of most of the machinery in a modern plant is not set at longer than twenty-five years."

Speed, Torque and Power in Machine-Tool Work

Some Factors to Consider in Selecting Motors—Limitations of Constant-Speed Units and Advantages of the More Expensive Adjustable-Speed Motors in This Line of Work

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SYNOPSIS.—Some of the factors which must be considered in determining the power required to drive given machine tools are discussed and the motor characteristics necessary for these conditions are outlined. Emphasis is placed upon the remarkable changes which have been wrought in the field of motor applications by the introduction of the adjustable-speed motor for machine-tool driving. Some of the limitations to the use of the constant-speed motor are outlined, and examples of cases are cited where there is an unquestionable advantage in the installation of the more expensive adjustable-speed motor with its special control equipment. Reference is made to the general classes of speeds employed and methods used in determining the horsepower rating of motors necessary for practical cases. The discussion is purposely carried out in a fundamental manner to serve as a groundwork for more detailed treatment of the subject which will be presented in a subsequent issue of the ELECTRICAL WORLD.

CLASSIFIED according to speed, motors may be considered as falling in three classes, (a) constant-speed, (b) variable-speed, and (c) adjustable-speed machines. Classes (b) and (c), while clearly relating in turn to motors in which the speed falls off with increasing load owing to inherent characteristics of the motor, and to motors in which the speed may be adjusted over wide limits for given loads by external control, are terms which even now are used loosely in the machinery building trades. For example, there is a fairly prevalent custom of referring to the adjustable-speed motor as a variable-speed machine.

It is well to keep clearly in mind that the term "adjustable speed" means, in the ideal case, a motor which for a given adjustment of the controller operates at a constant speed for all loads, as it places the adjustable-speed motor in an entirely different class from the variable-speed-with-load motor.

Quite a few cases occur, where the machinery operates continuously at approximately constant speed, in which the constant-speed motor covers the needs of the case. Its advantages over mechanical driving methods then become almost altogether those due to the general points favoring electric drive in contrast with line-shaft and belt drive, as outlined in previous discussions of this phase of the subject.

It is perhaps well to note at this point that while direct-current constant-speed motors of the non-commutating-pole type may apparently be adapted to speed increments of, say, 50 or even 100 per cent above normal by ordinary field control, the magnetic saturation of the iron required for lower speeds and the poor commutation obtained at higher speeds limit the operation of such motors to relatively small ranges of speed. The characteristics of the variable-speed motor are so well known that they need not be referred to here, and particularly so because of the more or less special nature of its applications, some of which will be referred to in subsequent articles.

Consider, however, the two cases in Fig. 1, which indicate respectively the maximum and minimum diameters of work to be handled by a lathe in a certain case. On the basis of the minimum cutting speed desired in the first instance and the maximum cutting speed desired in the second, the minimum and maximum

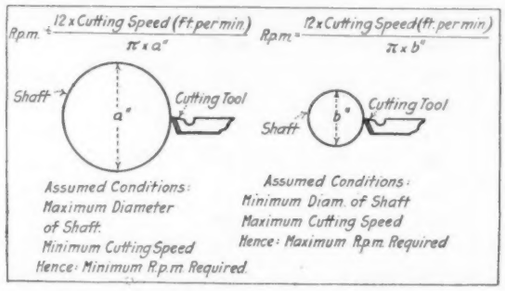


FIG. 1—EXAMPLE OF MOTOR-SPEED LIMITS WHICH MAY BE IMPOSED BY WIDELY VARYING SIZES OF WORK

revolutions per minute at which the spindle must be operated follow immediately.[1] In some cases the ratio of the maximum and minimum revolutions per minute may be relatively large, in fact, so much so that the ordinary adjustable-speed motor is not usually required to give this complete speed range without the addition of a back gear. Furthermore, in a machine which can accommodate such a wide range in diameters, many intermediate sizes of work are likely, with the corresponding necessity for intermediate revolutions per minute if the most economical cutting speeds are to be em-

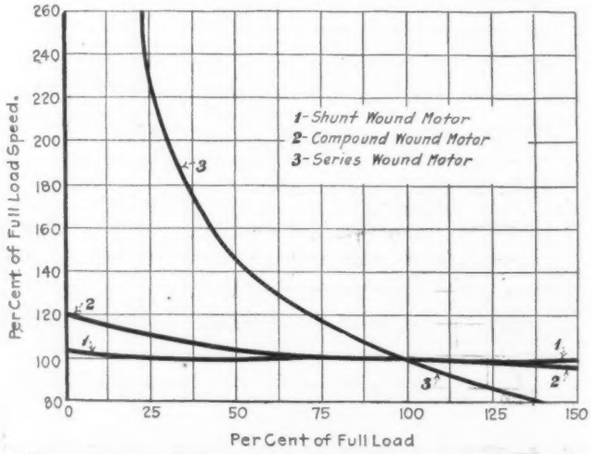


FIG. 2—TYPICAL SPEED-LOAD CURVES FOR SHUNT, SERIES AND COMPOUND MOTORS

ployed for each diameter. It follows, therefore, that adjustments for wide speed limits as well as for numerous intermediate speeds are often required, the latter being limited only by the variations in the sizes of

[1]This point is to be discussed more in detail in connection with the operation of lathes, in a subsequent article, and hence is merely referred to here in a general manner by way of illustration.

work being done on the particular machine tool in hand. The speed characteristics[2] necessary for such work are illustrated in Figs. 2 and 3.

Several years ago a prominent machine-tool expert made a statement (before the appearance of the adjustable-speed motor) to the effect that if a three to one speed-range motor should be developed and have no

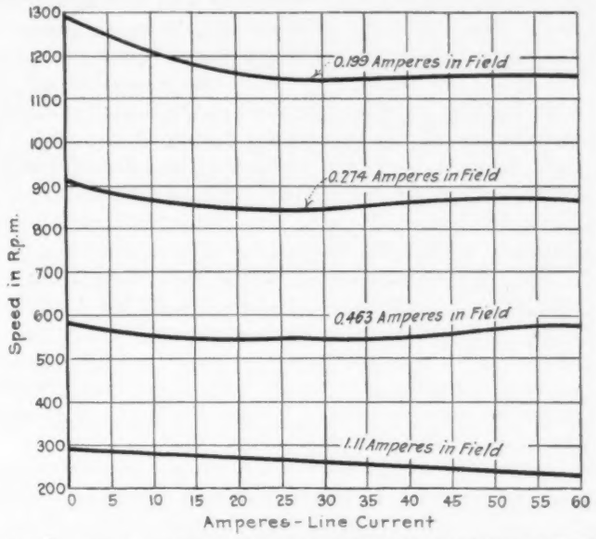


FIG. 3—SPEED-CURRENT INPUT CURVES FOR VARIOUS DEGREES OF EXCITATION IN ADJUSTABLE-SPEED MOTORS

greater variation than, say, 4 per cent in any part of the entire range of speeds and loads, a great step will have been taken toward the millennium of the machine-shop engineer, who is vitally concerned with cutting speeds. The curves in Fig. 3 show how near the modern commutating-pole, adjustable-speed machine has approached the ideal of constant speed with varying load for each given field current.

TORQUE CHARACTERISTICS

The duty cycle of typical machine tools, as shown by the record of a graphic meter, indicates the mechanical requirements of the load in terms of the electrical input to the motor. These records often show a marked peak at one or possibly several parts of the duty cycle, where relatively high torque is required to meet the requirements of the load. Considerably lower torque is required for the other portions of the cycle.

Consider Fig. 4, for example,[3] which represents the approximate input current to a motor driving pipe-threading machinery. An excessive peak is evident near the center of the diagram and a relatively large demand for current occurred during the threading operation (to the right) compared with that during the facing and rounding-up operations (on the left). In general, therefore, the duty cycle of the driven machine, while it may be periodic, is both irregular and erratic.

In applying a motor to any given load where the duty cycle is irregular and where the mechanical demands on the motor are exceedingly variable throughout the cycle there is wide opportunity for a judicious selection of a motor which first of all shall be capable of meeting these mechanical demands effectively at each point in the cycle, and, second, for the use of a motor of the most economical size (see Fig. 5).

There has undoubtedly been an unfortunate tendency in the past to use motors which possess a higher horsepower rating than necessary. This may often be due in part to unwarranted emphasis upon the maximum or peak requirement during the cycle. Apparently a motor selected on a basis of the peak, and particularly if the peak be of a short-time duration, may be considerably larger than is required by the average demand and will hence represent an investment in excess of the actual requirements.

The solution in such a case depends on the determination of this average demand and then on the selection of a motor with a corresponding rating but which is capable of meeting the excess of the peak without exceeding its heating limits and commutation. It is very important in this connection to note that one of the principal advantages commonly assigned to the commutating-pole, adjustable-speed motor is its ability to supply high overloads for short periods with satisfactory commutation and, of course, it is assumed, without overheating.

On the basis given application engineers have grown accustomed to selecting a motor for a given duty cycle with a rating corresponding to the average demand, concluding that a certain percentage of overload during one or more periods of the duty cycle can be handled by the commutating-pole motor satisfactorily. It has been explained, however, by A. C. Lanier (see footnote 2) that there is a definite limiting current intake for a commutating-pole motor beyond which the uncompensated voltage causes objectionable sparking.[4]

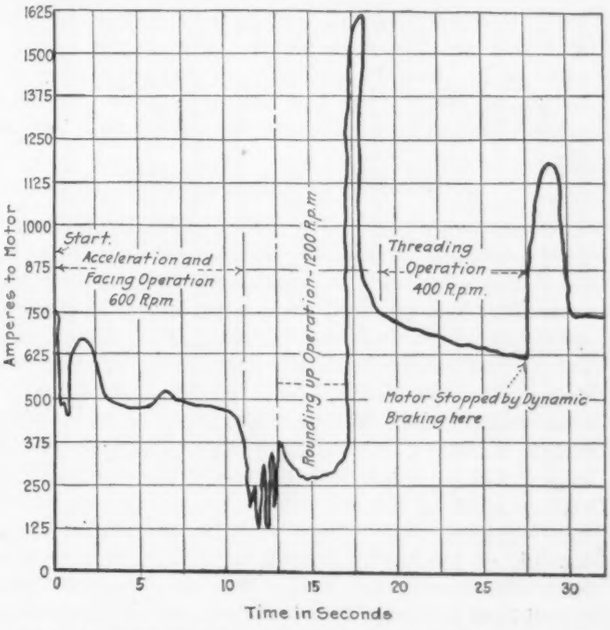


FIG. 4—DUTY CYCLE OF MOTOR DRIVING PIPE-THREADING MACHINERY

Hence it follows that the overload values of which the commutating-pole motor is capable have definite limits, as in the case of the older non-commutating-pole machines. Even if these limits are higher in the modern

[2]Fig. 2 is based on a discussion by A. C. Lanier, *Transactions A. I. E. E.*, Vol. 34, p. 177, and Fig. 3 on an article by the author in the *American Machinist*, Vol. 41, No. 19 (1914), p. 803. See also an article by the author, *American Machinist*, Vol. 41, No. 12, p. 491.

[3]From discussion by E. A. Lof, *Transactions A. I. E. E.*, Vol. 34, p. 767.

[4]To be discussed more fully in a subsequent article dealing with the electrical features of machine-tool motors.

types, the fact that they are definite makes it unusually important for the application engineer to exercise due care in his allowances for the excess loads which may be thrown onto the motor.

Although caution has just been suggested in the degree of overloads imposed on the adjustable-speed motor, good engineering dictates the use of the allowable

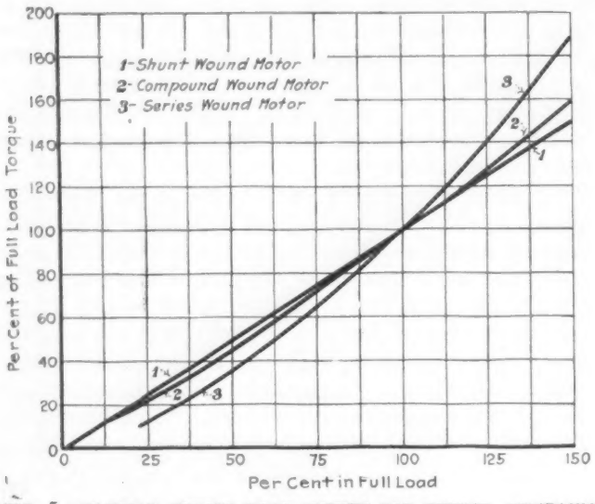


FIG. 5—TYPICAL TORQUE-LOAD CURVES FOR SHUNT, COMPOUND AND SERIES MOTORS

overloads up to the limits of good commutation and normal heating in the numerous cases where the average load requirements throughout the duty cycle are much below the few peaks which may occur in each cycle. The marked tendency, found in practical cases, to employ motors larger than necessary is shown graphically in Fig. 6. These examples are selected from figures of various authorities and merely indicate how undesirable this practice may become if it is not properly watched by those in a position to make a suitable selection of motor type and rating for the individual cases which arise almost continuously in the average plant.

Horsepower Determinations

As shown by Fig. 4, the actual current intake by a motor involved varies over a considerable range and the different values of current obtain for different time intervals. The problem, then, is to determine the rating of the motor which will be capable of supplying the various mechanical loads throughout the repeated duty cycle.

Several methods have been suggested for this determination, taking into account the variations of the load, and these will now be outlined briefly so that they may be used in the subsequent treatments of specific motor applications. Obviously, the horsepower rating depends on the heating produced by the varying current throughout the cycle. The two methods suggested here are based on a comprehensive discussion of direct-current motors for industrial applications[5] by A. C. Lanier.

Method I.—If the motor is subject to a well-defined cycle which goes through more or less regular repetitions, the losses in the motor will consequently vary throughout the cycle, and hence the heating and cooling rates. From these facts as a starting point it would be possible to plot a curve resulting from separate elements of individual heating and cooling curves as the current assumed higher or lower values during the cycle. Then the ultimate temperature of a given motor under consideration might be determined. However, it has been shown that when the load throughout the cycle does not vary over an unduly large range or where the time intervals of successive current demands are short the average value of the losses during the total working time may be used as the basis for the determination of the horsepower rating of the motor to use. In such cases that motor may be selected (as far as its horsepower is concerned) whose temperature rise for a like value of losses does not exceed safe limits throughout the total working period.

Method II.—Because of the difficulties so often encountered in securing a definite idea of the true duty cycle, and, moreover, where ordinary conditions of work make it unwise to attempt undue accuracy on account of irregularities which are so likely to arise, the root-mean-square value of horsepower may be taken as the basis of the rating to select.[6]

Abbreviating the term root-mean-square horsepower as r.m.s.h.p., the following equation may be written:

$$\text{r.m.s.h.p.} = \sqrt{\frac{\Sigma(\text{hp.}_1 \times t_1 + \text{hp.}_2 \times t_2 + \dots)}{t_1 + t_2 + \dots + \text{periods of rest}}}$$

where the r.m.s.h.p. is seen to be the result found by multiplying the hp. for one interval, throughout which this value of hp. may be considered constant, by the time t of the interval. This process is repeated for each part of the duty cycle, and all these products are added. This sum is then divided by the total time of the duty cycle including rest periods. The square root of this result is the desired value of the r.m.s.h.p.

Based on the horsepowers of various motors of the type to be used for different operation intervals and under approximately the same thermal conditions as those to be experienced in the given duty cycle, a choice may be made of the horsepower rating of the motor to be employed for the given case.

The above considerations demonstrate that the adjustable-speed motor has filled an unusually important place in the motor-application field. It is proposed, moreover, in a subsequent discussion to give this point still greater emphasis on a basis of the economic advantages which it affords in many practical cases.

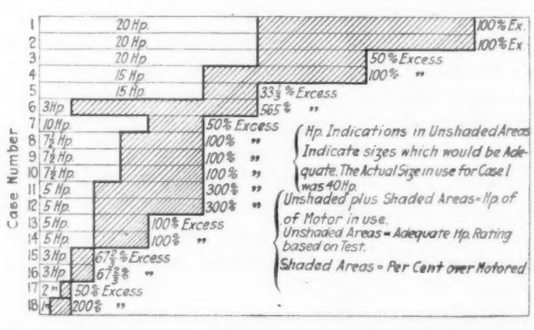

Case Number
1 20 Hp. 100% Ex.
2 20 Hp. 100% Ex.
3 20 Hp. 50% Excess
4 15 Hp. 100% "
5 15 Hp. 33⅓% Excess
6 3 Hp. 565% "
7 10 Hp. 50% Excess
8 7½ Hp. 100% "
9 7½ Hp. 100% "
10 7½ Hp. 100% "
11 5 Hp. 300% "
12 5 Hp. 300% "
13 5 Hp. 100% Excess
14 5 Hp. 100% "
15 3 Hp. 67⅔% Excess
16 3 Hp. 67⅔% "
17 ½ 50% Excess
18 ½ 200% "
Hp. Indications in Unshaded Areas Indicate sizes which would be Adequate. The Actual Size in use for Case I was 40 Hp.
Unshaded plus Shaded Areas = Hp. of Motor in use.
Unshaded Areas = Adequate Hp. Rating based on Test.
Shaded Areas = Per Cent over Motored

FIG. 6—TENDENCY TO OVER-MOTOR IN INDUSTRIAL PLANTS

[5] A. C. Lanier, *Transactions A. I. E. E.*, Vol. 34, p. 191. The reader will also find Mr. Lanier's treatment of motor heating and ventilation beginning on page 188 of this same reference a most interesting discussion bearing on this phase of the subject.

[6] Mr. Lanier qualifies the general use of this method by suggesting that it is most applicable to motors with relatively flat efficiency curves.

Service Extension Problems in California

Electric Utilities Must Pay Cost Within Corporate Limits When Acting Under General Franchise Unless Burdensome—For Rural Work No Rule Exists

BY JAMES F. POLLARD
Assistant Electrical Engineer California Railroad Commission

A PERPLEXING problem constantly confronting electric utility management is to determine where to draw the line between extensions of distribution facilities that should be constructed at the company's expense and those for which the consumer should pay all or a part of the cost of installation.

A discussion of this question by representatives of several central station companies in Ohio, as reported in a recent issue of the ELECTRICAL WORLD, seems to indicate that the general practice in that State is to require prospective residence lighting consumers to advance all of the cost of the necessary extension in excess of a stated sum per consumer. This sum varies as between companies from $15 to $25.

POLICY FOLLOWED BY CALIFORNIA COMPANIES

Apparently a somewhat more generous policy in this regard has been followed by most of the companies in California. Since the public utilities act became effective in that State, about four years ago, this matter has been subject to regulation by the California Railroad Commission. Theretofore some of the companies had established a more or less general policy as to extensions. They would build at their own expense extensions to serve business which promised a gross revenue of 33 1-3 per cent of the local investment in new lines and equipment. Some division of costs was required if the revenue was expected to be less than that.

In a city where the average consumer's bill is $1.50 per month, for instance, an extension required to serve a residence of normal size would result in an annual gross revenue of about $18, and the serving company would agree to make such an extension at its own expense for a consumer of this class up to a cost of $54.

It must be recognized that the application of any policy of this kind will not be equitable in all cases, inasmuch as the annual cost of the service to a given consumer is not a direct function of the cost of the local investment.

There are other governing factors which remain constant whether a long line extension or a short one be required to reach the consumer's plant, as, for example, the fixed charges on generating capacity required to serve a given load and the cost of meter reading, billing and other office expense. The only factors which are in direct relation to the local investment are the interest, depreciation and maintenance thereof.

The California Railroad Commission early found it necessary to consider this question as well as a number of others leading to the establishment of uniform practices among the ninety-odd electric companies in the State. After extended investigations and hearings the commission rendered its decision in these matters on Nov. 5, 1915. Its ruling deals with the question of extensions as classified under two divisions, viz., those within incorporated territory and those in rural districts.

Cases covered by the first of these classes are governed by the following rule:—

"A water, gas, electric or telephone utility which operates under a general franchise authorizing the occupancy of all the streets of a municipality shall make, at its own expense, such street extensions as may be necessary to serve applicants; provided, that in any case in which the construction of an extension at the utility's sole cost will in its opinion work an undue hardship upon the utility or its existing consumers the matter may be submitted to the commission as provided by Section 36 of the public utilities act, unless satisfactorily adjusted by an informal application to the commission."

In making this rule the commission recognized the obligation of a utility which enjoys a general franchise within a municipality to serve adequately all of the inhabitants of that municipality unless very unusual circumstances make the discharge of this obligation an unreasonable hardship, in which event the burden of the proof that such circumstances exist is placed upon the utility.

In general, where the boundaries of the municipality are not spread out to unreasonable limits, the saturation of load on the lines in the more populous sections of the city furnishes adequate compensation to the utility for the less remunerative extensions in the outskirts.

The territory included within the corporate limits of some cities in California has been artificially expanded on account of real estate "booms" and through similar causes, so that the indiscriminative extension of facilities in the sparsely settled suburbs is entirely out of the question. The Railroad Commission has indicated its readiness to relieve a utility from the obligation imposed by this rule in any municipality where the existence of such a condition can be established.

The question of service extensions in unincorporated territory is not so susceptible to a definite general ruling, and the commission has practically left this open for decision after special consideration of the conditions surrounding each individual case.

RURAL CONDITIONS IN THE STATE

California's rural conditions are materially different from those in most of the Eastern States, in that there are many vast tracts of land suitable for agricultural development as yet unused except for cattle or sheep ranges. And even in the districts where the land is under cultivation the holdings are in larger units than is commonly the case in the East, so that the problem of delivering electric service to the ranchers is not very attractive to the utilities on account of the long lines which must be constructed to serve comparatively few.

Under these conditions, in dealing with the subject of extensions in rural territory, the commission made a separate ruling to the effect that the electric utility

"shall make such reasonable extensions in unincorporated territory at its own expense as it can agree upon with the applicant for service," with the further provision that in cases where an agreement cannot be reached the matter may be decided by the commission.

A great deal of agricultural land in the State requires irrigation, and a large portion of such land is supplied with water from underground sources through electrically driven pumps. The average plant, ranging from 5 hp. to 15 hp., is sufficient to water from 40 acres to 80 acres. Such districts are usually well covered with distribution networks ranging in potential from 2000 volts to 11,000 and 15,000 volts.

Requests for further extension of these systems involve considerations as to whether the immediate net result will be a financial loss to the company, and if this appears to be the case, whether the availability of electric service will foster development which may be expected to result in enough future business to warrant the company in assuming the burden of the prospective loss during the development period.

The first of these considerations is, of course, of interest to the public as well as the utility, inasmuch as it will eventually have an effect upon the rates to all consumers served by the company in question. It cannot be correctly answered, therefore, without a knowledge of the general condition of all of the company's business. If the utility is serving any considerable territory that is densely populated, and therefore very profitable, and if its business as a whole is netting a fair return on its capital invested, it may be reasonably expected to make many more unattractive extensions than would a company in a less favorable condition.

Basing Rates on Average Conditions

The principle which must be constantly borne in mind is that public utility rates must perforce be predicated upon average conditions. Therefore, the utility's obligation to serve adequately the territory which it occupies requires it to make some extensions which are expected to result in a net revenue more or less below the average, so long as there are reasonable prospects of taking on at the same time other business at returns considerably greater than the average.

Oftentimes a utility manager contends that he should not be expected to make a given extension, because it will not bring in some specified net return, as, for example, 8 per cent on the local investment. He bases his argument on the fact that the commission in some previous proceeding has indicated this to be a fair return to be used for general rate-fixing purposes on his system. If this line of reasoning were accepted, the obvious outcome would be that the utility would never take any business below this figure. Unquestionably much of its new business would bring a higher return, and the net result would be a total earning considerably greater than the commission had found to be proper.

What, then, is the lowest limit of return to which a utility may be reasonably expected to go in considering unprofitable extensions?

It has been suggested that if a given extension will just carry its own cost, and if its addition will not result in any actual loss, it is entirely proper to expect the utility to build it, the following items being those which should be considered as making up this cost:

(a) Interest on the investment in the extension itself, at the average rate which the utility finds itself compelled to pay for borrowed capital.

(b) Depreciation, computed on the sinking-fund basis and with regard to the average life of the class of material used in the extension.

(c) Average maintenance costs on this class of equipment.

(d) Consumer costs, which may be taken as the average expense per consumer of reading meters, keeping accounts, billing and collecting.

(e) Taxes (in California they are 5.6 per cent of the gross income).

(f) Energy cost, based on the estimated amount of consumption which the new business will require at the bare cost to the company of delivery to its network.

If the total of these items of annual expense is just equal to the estimated annual gross revenue, the utility will at least suffer no loss and be in no worse position if it takes on the business in question than if it refuses to do so. There is, of course, a limitation in connection with such a scheme. If forced to take an absurd preponderance of such business, the amount of money invested without profit might become excessive as compared to the stockholders' equity, upon which a reasonable profit is entirely proper. The fact should be borne in mind, however, that it can reasonably be assumed that sufficient profitable business will be added at the same time to offset this feature. Where the above method of figuring extensions is employed due regard must in each case be given to future development.

In some instances, even though the prospective revenue is so low as clearly not to justify the utility in extending its lines at its own expense, the service is of such a value to the consumer that he is willing to assume a part or all of the burden of installing the necessary facilities. This may be done in several ways:

1. The consumer may advance all or a part of the cost of the extension and either retain ownership in the line or turn it over to the company. In the latter event it is customary to reimburse the consumer by means of a discount of his bills during a definite prearranged period of time or until the line is paid for.

2. The consumer may guarantee to the company a revenue over and above that which he would normally be expected to pay and which is at least equivalent to that outlined in the above cost of service. In this case the lines are built at the company's expense.

3. It has been suggested, though the writer has never known this suggestion to be carried out, that the consumer might be required to give some satisfactory bond which would guarantee a fair return on the company's investment during the life of the service and would save it from loss due to the cost of installing and removing the service equipment, together with any abnormal depreciation in the value of the material in the event that the extension is abandoned at any time before these expenses have been absorbed through the normal depreciation and amortization funds.

In connection with the first of these methods, if the consumer's advance is to be refunded as a percentage of his monthly bills, the question often arises as to the rate at which such refunds shall be made. A convenient rule to follow in this regard is to discount the consumer's bills by the same percentage that the gross revenue from the extension bears to its original cost.

Another frequent cause of dispute between electric

companies and their consumers is as to whether the utility must extend its lines across private property. A recent ruling of the Supreme Court which appears to have a bearing on this problem is to the effect that a railroad spur track which was required for the sole service of a single shipper and was on private property was not part of the railroad's public service.

If, however, a service line on private property may be extended and used for the service of other consumers, and if the utilities' ownership therein is protected by proper right-of-way grants, other considerations being favorable, it would seem to be of essentially the same status as a line along a public highway, and it is frequently so considered.

The utilities law existing in the State of Ohio specifically provides that a valuation for rate-fixing purposes must be made on the basis of reproduction new at the time of the rate investigation. Under these circumstances expensive extensions constructed at the present time might be materially discounted for rate-fixing purposes when prices have returned to normal.

This condition does not exist in California. The public utilities act there does not prescribe a definite basis for valuations, but leaves this to the discretion of the commission. Its decisions have clearly indicated that it will consider the actual investment in cases where this can be determined and where it was made in good faith and with reasonable business judgment.

Effects of Unsymmetrically Spaced Conductors

Unbalanced Loads Cause More Voltage Unbalance in Four-Wire Star-Connected Circuits Than in Three-Wire Delta-Connected Circuits—Single-Phase Regulators, Transposition of Conductors, Etc., Are Remedies

BY GEORGE S. HUMPHREY

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WHEN the conductors of three-phase circuits are supported equidistant from each other and the load is balanced between the phases the voltage drops between the conductors are equal. However, the conductors of most distribution lines are not arranged in the form of an equilateral triangle, and the load is not always balanced between phases, so that the conditions are quite different. In this article, therefore, the author will call attention to some of the practical effects of unbalanced loads and unsymmetrical spacing of conductors on the voltage drop in distribution lines. Since the effect of electrostatic capacity on low-voltage lines is negligible, it will be disregarded.

From the examples given in the following text it may be noted that there is less unbalance in actual voltage caused by the unbalanced loads and unsymmetrical conductor spacing on a three-wire delta-connected three-phase circuit than on a four-wire star-connected circuit similarly loaded. However, there is a greater unbalance in the phase angles between voltages with the three-wire circuit. The drop in the neutral wire in a four-wire circuit is such as to increase the load voltage on the phase having the smallest load and decrease that on the phase having the greatest load. Moreover, the load currents in three-wire circuits combine to produce line currents which are less unbalanced than the load currents. Consequently greater care must be taken to keep the load on four-wire circuits balanced between phases. If it is impossible to obtain an approximate balance, the position of the several phase wires with respect to the neutral and the direction of phase rotation should be considered, since balanced voltages may be obtained even with unbalanced load. It is theoretically possible so to arrange conductors that balanced voltages may be obtained with any degree of unbalanced load, but this, of course, is impracticable.

If reasonable care is taken to balance the load, the unbalance in voltage caused by placing the phase conductors on the middle and end pins of standard N. E. L. A. six-pin cross-arms is not enough to be serious for conductors not larger than No. 2 copper. Phase conductors larger than No. 2, however, should preferably be placed on adjacent pins, since the larger ratio of reactance to resistance of large conductors makes the unbalance in voltage greater. The difference in voltage drop in the several phases may be overcome by the use of single-phase regulators, each properly compensated, including a compensator for the neutral wire of four-wire circuits. One or more banks of transformers connected to the circuit and delta-connected on the secondary side will also provide an approximate voltage balance, but the transformers must have sufficient capacity to carry the necessary circulating current in addition to their normal load current without heating. Transposition of conductors will also assist in balancing the load voltages. Regardless of what is done to offset the ill effects of unsymmetrically spaced conductors, the effective resistance and reactance of each conductor in a circuit will vary with each change of current in the conductors.

To demonstrate these facts, the formulas used in deriving the reactance drop, etc., will be presented first and then some typical problems will be solved.

The inductive reactance per wire per 1000 ft. (304 m.) of a single-phase, 60-cycle circuit may be determined from the following formula:

$X = 0.05275 \log 10(D - r)/r + 0.00573$, where X = ohms per wire per 1000 ft., D = distance between centers of conductors, and r = radius of conductor (both same size). The variation of inductive reactance with different spacings between conductors is shown graphically by Fig. 1 for No. 6, No. 2 and No. 2/0 copper wires.

The formula above and the curves in Fig. 1 apply also to three-phase lines if the load is balanced between the three phases, and, further, if the conductors are equidistant from each other. However, the conductors of most distribution lines are not arranged in the form of an equilateral triangle, and the loads on many of them are not balanced between phases.

Consider the three conductors A, B and C in Fig. 2, at distances D_{ab}, D_{bc} and D_{ca} apart and carrying currents I_a, I_b and I_c respectively. The conductors will all be considered the same size, having radius r. If conductors A and B were part of a single-phase circuit, the current in A would be equal and opposite to that in B ($I_a = -I_b$) and the reactance of each conductor would be equal to that of the other. Since conductors A, B and C make up a complete circuit, any two of them may

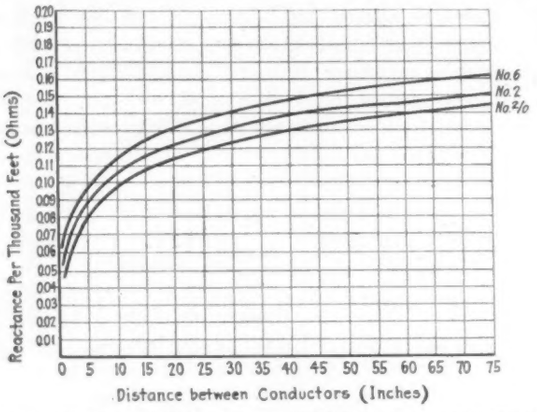


FIG. 1—UNIT REACTANCE OF DIFFERENT-SIZE CONDUCTORS WITH DIFFERENT SPACINGS

be considered returns for the third, and $I_a = -(I_b + I_c)$; $I_b = -(I_a + I_c)$, and $I_c = -(I_a + I_b)$.

The reactance of conductor A with respect to conductor B will be denoted by X_{ab}; of B with respect to C by X_{bc}, and of C with respect to A by X_{ca}. The reactance drop in conductor A is the vectorial sum of the portion of its current which flows in B times the reactance between A and B ($-I_bX_{ab}$), and the portion of its current which flows in C times the reactance between A and C ($-I_cX_{ca}$). That is the reactance drop in conductor A is $I_aX_a = -(I_bX_{ab} + I_cX_{ca})$. Similarly $I_bX_b = -(I_aX_{ab} + I_cX_{bc})$ and $I_cX_c = -(I_aX_{ca} + I_bX_{bc})$.

From formula (1), $X_{ab} = 0.05275 \log 10(D_{ab} - r)/r + 0.00573$; $X_{bc} = 0.05275 \log 10(D_{bc} - r)/r + 0.00573$; $X_{ca} = 0.05275 \log 10(D_{ca} - r)/r + 0.00573$.

Obviously the number of conductors may be increased at will, and the reactance drop in any of them may be determined in the same way regardless of inequality of currents, or their phase angles, or unequal spacing of conductors.

APPLICATION OF PRINCIPLES

Problem I.—Consider first a circuit 3 miles (4.8 km.) long consisting of three No. 2 copper conductors with a 36-in. (91.4-cm.) equilateral triangular spacing and a balanced load of 26.7 amp. per phase (46.2 amp. per line), with 2300 volts at the generator end and a power factor of 0.80 (see Fig. 3).

The resistance of each conductor is 2.69 ohms and its reactance 2.14 ohms. Since the load is balanced and the conductors are symmetrically spaced, the drop in each of the three conductors will be the same. The load voltage on any phase is 2025, and the voltage drop is 12 per cent of the generator voltage, as may be found by any of the usual methods of calculating line drop.

Problem II.—Consider now the same circuit as in Problem I, with the same total load, but with one-third less current in one phase than in either of the other two (see Fig. 4).

The problem can be solved by using complex quantities, and the small phase difference between the generator voltages and the corresponding load voltages will be disregarded (viz., E_{ab} considered in phase with $E_{a'b'}$, etc.). Assuming a vertical line of reference,

$E_{ao} = 1328 + j0$ $\quad I_{a'b'} = 29.8 - j3.6 = (30$ amp.)
$E_{bo} = -664 - j1150$ $\quad I_{b'c'} = -12.0 - j16.0 = (20$ amp.)
$E_{co} = -664 + j1150$ $\quad I_{c'a'} = -11.8 + j27.6 = (30$ amp.)

$I_{aa'} = I_{a'b'} + I_{a'c'} = 41.6 - j31.2 = (52.0$ amp.)
$I_{bb'} = I_{b'c'} + I_{b'a'} = -41.8 - j12.4 = (43.6$ amp.)
$I_{cc'} = I_{c'a'} + I_{c'b'} = 0.2 + j43.6 = (43.6$ amp.)

$E_{aa'} = (41.6 - j31.2)(2.69 + j2.14) = 179 + j5$
$E_{bb'} = (-41.8 - j12.4)(2.69 + j2.14) = -86 - j123$
$E_{cc'} = (0.2 + j43.6)(2.69 + j2.14) = -93 + j118$

$E_{a'o} = E_{ao} - E_{aa'} = 1149 - j5$
$E_{b'o} = E_{bo} - E_{bb'} = -578 - j1027$
$E_{c'o} = E_{co} - E_{cc'} = -571 + j1032$

$E_{a'b'} = E_{a'o} + E_{ob'} = 1727 + j1022 = 2007$ volts
$E_{b'c'} = E_{b'o} + E_{oc'} = -7 - j2059 = 2060$ volts
$E_{c'a'} = E_{c'o} + E_{oa'} = -1720 - j1037 = 2008$ volts

Average ..... = 2025 volts

The average voltage drop is 12 per cent of generator voltage as in Problem I, but the drop in phases *ab* and *ca* is 12.7 per cent, while that in phase *bc* is 10.4 per cent. The maximum unbalance in load voltage is 1.7 per cent from the average. One line (star) current is 20 per cent greater than the other two, while two load (delta) currents are 50 per cent greater than the third.

Problem III.—Consider now the same line and load as in Problem I, but with a flat spacing of 14½ in. (36.8 cm.) between the middle and either outside conductor, as would be the case if the circuit were placed on one end of a N. E. L. A. standard six-pin cross-arm (see Fig. 5).

The reactance of each of the circuits *ab* and *bc* is 1.80 ohms, while that of *ac* is 2.05 ohms. Using the same axes as in Problem II.

$I_{aa'} = 37.0 - j27.7$ $\quad E_{aa'} = 161 - j9$
$I_{bb'} = -42.5 - j18.1$ $\quad E_{bb'} = -82 - j125$
$I_{cc'} = 5.5 + j45.8$ $\quad E_{cc'} = -75 + j124$

$E_{a'b'} = 2032$ volts, $E_{b'c'} = 2052$ volts, $E_{c'a'} = 2029$ volts, an average of 2038 volts.

It should be noted that the resistance and reactance of the middle wire are the same as for equilateral-triangle construction. The equivalent resistance and reactance of the two outside wires may be found by dividing the voltage drops ($E_{aa'}$ and $E_{cc'}$) by the respective currents, which gives the following for the equivalent impedances of the several conductors: $Z_a = 2.91 + j1.94$; $Z_b = 2.69 + j1.80$, and $Z_c = 2.47 + j1.94$. The non-symmetrical arrangement operates to increase the resistance of the conductor which carries the current, leading that in the middle conductor by 0.22 ohm, and decreasing that of the third conductor by the same amount. This is due to transformer action between the two circuits formed by the middle wire and either of the two outside wires. The effect is independent of the size of conductors and also of their spacing, so long as the middle one is midway between the other two and amounts to

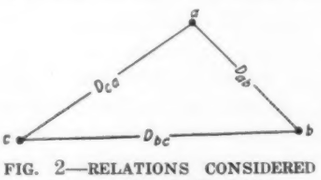


FIG. 2—RELATIONS CONSIDERED IN DEVELOPING PRACTICAL ANALYSES

0.073 ohm per mile (0.045 ohm per km.) for 60-cycle circuits. The maximum unbalance in load voltage with balanced currents is 0.7 per cent from the average.

Problem IV.—Next consider the same line and load as in Problem III, but with two of the conductors placed on the middle and end pin of one end of a standard N. E. L. A. six-pin cross-arm, and the third on the middle pin on the other end, leaving the two-pole pin positions for series circuits (see Fig. 6).

Reactance of circuit *ab* (separation 14.5 in., 36.8 cm.) = 1.80 ohms; reactance of circuit *bc* (separation 59 in., 124.5 cm.) = 2.32 ohms; reactance of circuit *ca* (separation 73.5 in., 186.4 cm.) = 2.40 ohms.

Solving the problem in the same manner as before, it is found that $E_{a'b'}$ = 2038 volts; $E_{b'c'}$ = 2036 volts; $E_{c'a'}$ = 1994 volts, an average of 2023 volts. The equivalent impedance of each conductor, as found by dividing the complex expression for the drop by the corresponding current, is: $Z_a = 3.21 + j2.09$; $Z_b = 2.24 + j2.07$; $Z_c = 2.62 + j2.36$, an average of $2.69 + j2.17$.

The average equivalent resistance is found to be equal to the actual resistance of each conductor, and the average equivalent reactance is equal to the average of the reactances of the three pairs of conductors, since the load is balanced. The maximum unbalance in the load voltage with balanced current is 1.4 per cent from the average.

Problem V.—Consider now the same load as before, but unbalanced as in Problem II and with the conductors spaced as in Problem IV (see Fig. 7).

Solving, $E_{a'b'}$ = 2024 volts	$Z_a = 3.09 + j2.09$
$E_{b'c'}$ = 2077 volts	$Z_b = 2.18 + j1.91$
$E_{c'a'}$ = 1982 volts	$Z_c = 2.62 + j2.37$
Average = 2028 volts	Average = $2.63 + j2.12$

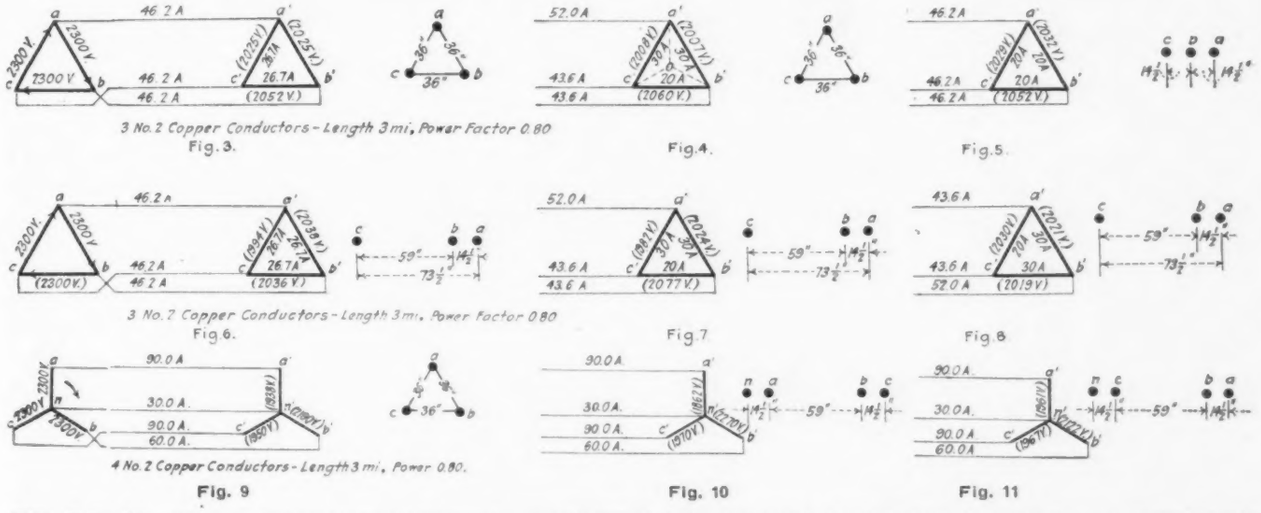
In this case the average equivalent resistance is not equal to the actual resistance of either conductor since the load is not equally divided between the conductors. However, the apparent increase in resistance of conductor *A*, multiplied by the square of the current flowing in it, must equal the sum of the apparent decrease in resistance in *B* and *C* multiplied by the squares of their respective currents. The maximum unbalance in load voltage is 2.3 per cent from the average with a maximum unbalance in load current of 25 per cent and in line current of 12 per cent from the average.

Problem VI.—Suppose the 20-amp. load on phase $b'c'$ and the 30-amp. load on phase $c'a'$ of Problem V are interchanged, and all other conditions are left as in Problem VII (see Fig. 8).

Solving, $E_{a'b'}$ = 2021 volts	$Z_a = 3.26 + j1.97$
$E_{b'c'}$ = 2019 volts	$Z_b = 2.34 + j2.06$
$E_{c'a'}$ = 2030 volts	$Z_c = 2.62 + j2.32$
Average = 2023 volts	Average = $2.74 + j2.12$

By transferring one-third of the load from phase $c'a'$ to $b'c'$ the maximum unbalance in load voltage is reduced from 2.3 per cent to 0.3 per cent of the average.

Problem VII.—Next consider a four-wire star-connected circuit with 2300 volts between phase wires and neutral and the same conductor spacing as in Problem II, with the neutral wire at the center of the 36-in. (91.4-cm.) equilateral triangle.


3 No. 2 Copper Conductors - Length 3 mi., Power Factor 0.80
Fig. 3.
Fig. 4.
Fig. 5.
3 No. 7 Copper Conductors - Length 3 mi., Power Factor 0.80
Fig. 6.
Fig. 7.
Fig. 8.
4 No. 2 Copper Conductors - Length 3 mi., Power 0.80.
Fig. 9
Fig. 10
Fig. 11

FIGS. 3 TO 11—SEVERAL PRACTICAL EXAMPLES OF UNSYMMETRICALLY ARRANGED CONDUCTORS CONSIDERED IN DETERMINING UNBALANCING EFFECT

Since the line voltage is $\sqrt{3}$ times that in Problem II, the currents will be made three times the corresponding previous currents in order to make corresponding line drops, since the capacity of a power line varies as the square of the line voltage (see Fig. 9).

The reactance of each pair of phase conductors is 2.14 ohms, while that of each phase conductor with respect to the neutral is 1.94 ohms. Solving, $E_{a'n'}$ = 1938 volts; $E_{b'n'}$ = 2190 volts; $E_{c'n'}$ = 1950 volts, an average of 2026 volts. The average drop is the same as in Problem II, but the maximum unbalance in load voltage from the average is 8.1 per cent instead of 1.7 per cent.

If the neutral wire were of No. 6 instead of No. 2 copper, the load voltages would be: $E_{a'n'}$ = 1846 volts; $E_{b'n'}$ = 2294 volts; $E_{c'n'}$ = 1960 volts, an average of 2033 volts. The average load voltage is slightly larger than before, and there is practically no drop in the *B* phase; however, the maximum unbalance is 12.8 per cent.

Problem VIII.—Consider now the same line and load as in Problem VII, but with the conductors placed on the two end and middle pins of a standard N. E. L. A.

six-pin cross-arm with the neutral on an end pin (see Fig. 10).

Solving, $E_{a'n'} = 1862$ volts	$Z_a = 3.02 + j2.21$
$E_{b'n'} = 2270$ volts	$Z_b = 2.02 + j1.89$
$E_{c'n'} = 1970$ volts	$Z_c = 2.48 + j2.28$
	$Z_n = 4.40 + j1.58$
Average = 2034 volts	Average = $2.98 + j1.99$

The average load voltage is slightly more than with the triangular spacing, but the maximum unbalance is 11.5 per cent. The average equivalent resistance is 11 per cent more than the actual resistance of one conductor. The maximum unbalance in both load and line current is 25 per cent from the average. The load currents in the three-wire delta circuit combine in such a way that the line currents are only half as much unbalanced as the load currents, and this is one reason for the greater unbalance of load voltage on the four-wire circuit. Another reason for this greater unbalance will appear later.

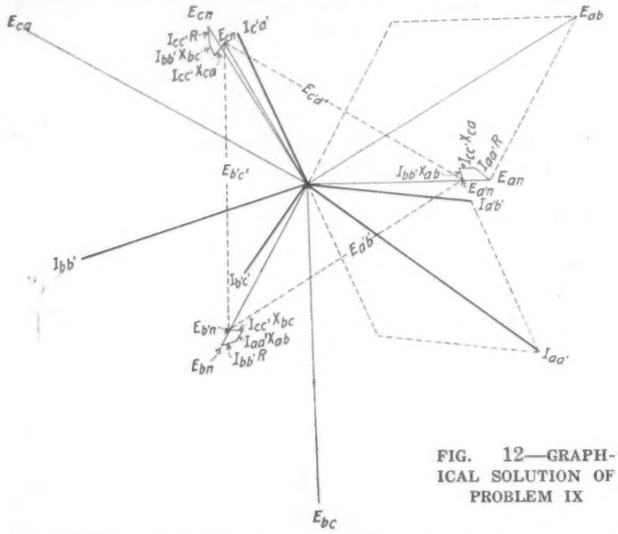


FIG. 12—GRAPHICAL SOLUTION OF PROBLEM IX

Problem IX.—Reverse the phase rotation of the conductors in Problem VIII and leave all other conditions the same as before (see Fig. 11).

Solving, $E_{a'n'} = 1961$ volts	$Z_a = 2.90 + j2.28$
$E_{b'n'} = 2122$ volts	$Z_b = 3.36 + j1.89$
$E_{c'n'} = 1967$ volts	$Z_c = 2.35 + j2.21$
	$Z_n = 1.00 + j1.58$
Average = 2017 volts	Average = $2.40 + j1.99$

The average load voltage is slightly less than before, but the maximum unbalance is only 5.2 per cent from the average. Thus the unbalance in load voltage was reduced by one-half by reversing conductors *A* and *C* with respect to the generator.

A graphical method of treating the problems which have been solved by use of the complex quantity will now be considered. Fig. 12 gives a graphical solution of Problem V.

First the generator star voltages (E_{an}, E_{bn} and E_{cn} = 1328 volts) are drawn to scale at angles of 120 deg. apart. The loads on three-wire circuits are usually delta-connected, so the star voltages will be combined to produce the delta voltages ($E_{ab} = E_{an} - E_{bn}$, etc.). Since the power factor of the load is 0.80 lagging, current $I_{a'b'}$ is drawn at an angle of 36° 52′ (cos 36° 52′ = 0.80) behind the corresponding voltage E_{ab}, etc. This current should actually be shown at angle 36° 52′ behind voltage $E_{a'b'}$, but since the latter voltage is unknown, the currents will be referred to generator voltages instead of load voltages, and the resulting error will be inappreciable. The load currents must then be combined into the line currents ($I_{aa'} = I_{a'b'} - I_{c'a'}$, etc.).

First consider the drop in conductor *A*. The resistance drop ($I_{aa'}R$) must be subtracted from generator voltage (E_{ab}); therefore it must be drawn exactly opposite in phase to current $I_{aa'}$ and equal to 52.0 × 2.69, or 140 volts. The reactance drop is made up of two components, since the current returns through two conductors located at unequal distances from the one considered. The reactance of the circuit formed by conductors *A* and *B* is 1.80 ohm, so the drop in *A* due to the part of its current which returns through *B* ($I_{bb'}X_{ab}$) is 46.2 × 1.80 = 83.2 volts. Since the current in *A* is in the opposite direction to its return current in *B*, and reactance drop lags 90 deg. behind the current producing it, the vector representing the reactance drop in *A* ($I_{bb'}X_{ab}$) of the current in *B* must be drawn 90 deg. ahead of the current $I_{bb'}$. In the same way the reactance drop in *A* due to the part of its current returning through *C* ($I_{cc'}X_{ca}$) equals 46.2 × 2.40 = 111 volts, leading current $I_{cc'}$ by 90 deg. The vector for voltage $E_{a'n}$ has now been found. In the same way the voltage drops in conductors *B* and *C* and the resulting load star voltages $E_{b'n}$ and $E_{c'n}$ may be found. The load voltages $E_{a'b'}$, $E_{b'c'}$ and $E_{c'a'}$ may then be measured to scale from the drawing.

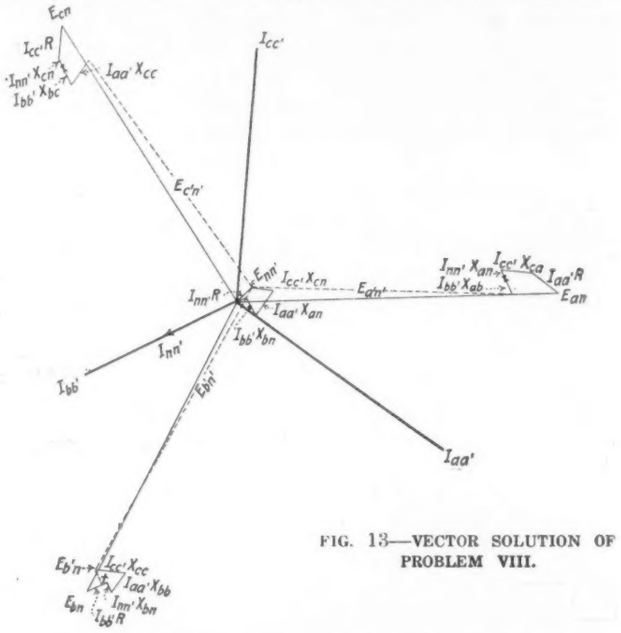


FIG. 13—VECTOR SOLUTION OF PROBLEM VIII.

Fig. 13 gives a similar vector solution of Problem VIII, the various vectors being computed and drawn exactly as before except that the work is somewhat more complicated by the addition of the current in the fourth or neutral wire. To find the effective resistance and reactance of each conductor a line is drawn from $E_{b'n}$ perpendicular to $I_{bb'}R$. The distance from E_{bn} to the point of intersection *X* will then be the equivalent resistance drop, and the distance from $E_{b'n}$ to the point of intersection (*X*) will be the equivalent reactance drop. The resistance and reactance drops measured to scale divided by the current give the equivalent resistance and reactance.

War Means Close Co-operation with Government

Under Present Conditions Government Finds It Absolutely Necessary to Deal with Each Industry as an Organized Unit—Electrical Manufacturing in the Future

BY CLARENCE L. COLLENS, II.
President Electric Power Club

FOREWORD.—Serving the government to the fullest possible extent, electrical manufacturers are under the vital necessity of so shaping their general policies that they shall be in complete accord with the crystallizing national idea of co-operation. The presidential address of Mr. Collens before the Electric Power Club meeting at Hot Springs, Va., on Nov. 12 and 13, published in part herewith, is a thoughtful presentation of the drift of tendencies before the war, of the conversion into definite co-operative action as a result of the war, and of the practical questions which should be taken into account in planning for the future.

THE past history of the Electric Power Club has been a consistent record of steady progress and growing influence, and it is naturally with a keen sense of responsibility that I have taken up the work of my predecessor in office. My first effort has been an attempt to formulate in my own mind the exact function of a trade organization such as the Electric Power Club, and I must confess that the more I have thought on the subject the more complex the problem has become.

I have started with the premises that unrestricted, unregulated competition is an evil of the past and that the competition of the future will always be tempered by co-operation among manufacturers, expressing itself in trade and industrial associations. Such associations are no longer viewed with suspicion by the purchaser or by the government. In fact, under present emergency conditions, the government has found it absolutely necessary to deal with each industry as an organized unit and not as individual manufacturers, and there are many favorable indications of a changing attitude on the part of the government in its relation to organized business. A single striking example is the recently created Excess Profits Advisory Board "to analyze the law and to digest and consider, in connection with plans for its administration, suggestions received from those who will be required to pay the taxes."

THE FUTURE OF INDUSTRY

Representatives of commercial and industrial organizations are being invited to sit with this board and take part in the discussions. Even discounting the present emergency conditions, we can take it for granted that industry in future will develop more and more into a triangle of relationships, buying public on the one hand, co-operating manufacturers on the other, and a supervising, regulating government in between. The conditions imposed by the war will foster close co-operation between organized business and the government, and any future necessity for an increasing degree of government regulation or control will be determined very largely by the manner in which co-operating business conducts itself. Proper self-regulation will mean a minimum of external regulation.

To what extent and in what ways can a trade organization exercise a proper and necessary function in this triangle of relationships? At what point in co-operation does rational competition cease and co-operation become combination in restraint of trade?

The answer is exceedingly simple, but its application is not. There is no limit to co-operation provided the end sought does not in any way work against the real interests of either one of the two main parties in the triangle of relationships. This means eliminating all conditions which work a hardship on the industry just as much as imposing no conditions which work a hardship on the purchasing public. To the extent that we will apply this principle any work undertaken will promote the interests of the industry as a whole and will meet with general approval. To the extent, however, that co-operation among manufacturers develops into one-sided self-seeking industry will invite for itself a well-earned and possibly more irksome form of government regulation and supervision than anything now contemplated.

SHOULD BROADEN OUR ENDEAVOR

In the past our effort has been largely that of standardizing the product manufactured. This work has now progressed to a point where it is merely one of perfecting the details of the framework already created. Valuable and absolutely necessary as this work has been and will continue to be, have we not now reached a point where we should attempt to broaden the scope of our endeavor and approach any other general problems which will promote the interests of the industry as a whole?

Are our commercial practices entirely free from injustices either to competitors or to purchasers? Are there any fixed policies on the part of the larger units in the industry, or of the smaller, which tend to limit proper competition, or are either monopolistic or destructive in tendency? Do we discriminate between buyers who have every right to equal consideration? We have standardized the product manufacturer, and I personally feel that we can now properly consider any general problems in the sale of that product, imposed either by buyer or by seller, which upset normal competitive relations between manufacturers or introduce unnecessary financial hazards in the industry.

We also have the practically untouched field of application problems and any interchange of information which will assist in extending the use of electrical machinery or in creating a wider market. Our standardization booklet should have complete data on the size of motor, proper basis of rating and usual type of control for all standard machinery. There is no reason why it should not become a standard textbook on the use and application of electrical machinery to the same extent as it is now a recognized standard for the rating of electrical machinery.

We should prepare for the opportunity to co-operate

in extending and strengthening the export market which will be possible with the passage of the Webb-Pomerene bill. This will probably receive early consideration by the Senate when Congress reconvenes. It has already passed the House.

Tendencies in Government Price Handling

Finally we have a right to satisfy ourselves that competitive conditions are not limiting the return in the industry to a point where the invested capital is not properly protected or, taking fully into account the risks and hazards of the business and the skill of design and manufacture required, which does not guarantee a proper progressive development. We have already taken two steps in the right direction, first, by standardizing the product manufactured, and second, by promoting a uniform system of cost accounting. I am not prepared to say how the third step can be taken and will simply mention some tendencies which are now evident in the way the government is handling the price question.

In the past the government has simply been interested in preventing restraint of trade, either by combination of competitors, collusion among competitors or elimination of competitors by unfair practices. Without such it has been felt that proper competitive conditions on the question of prices would be maintained by the ordinary laws of supply and demand. The war, however, has forced the government one step farther. Mr. Hoover, the Food Administrator, says: "The large question of the hour is price-fixing, for where the demand is far beyond the supply, whether food or otherwise, the old law of price-fixing by supply and demand is broken." This forces us to an interesting corollary. Is not the law of price-fixing by supply and demand equally broken when the supply far exceeds the demand? If the government limits prices to a normal profit during excessive demand, cannot manufacturers rightly demand of the government such control of competitive conditions as will properly protect the capital invested during subnormal business and excessive supply?

Secretary McAdoo recently described the conditions which would have existed among the farmers of this country if the government had acceded to Germany's demand, kept its ships at home and given up its rights to the free commerce of the seas. With the export trade suddenly cut off and a surplus supply at home, he said it would have been impossible to control the situation soon enough to prevent tremendous economic loss and damage. Actual price-fixing is, however, only an emergency measure which will not outlive the emergency which created it, because it cannot be carried to its logical conclusion without extension to all important elements of cost entering into every commodity, including even labor itself, and would die of its own stupendousness.

Another tendency of the government to curb excessive prices is a progressively increasing tax on excess profits. On the face of it, with a sufficiently high tax, this may seem a simple means of discouraging unreasonable prices, but it has what I consider an inherent defect. Excess profits which are the result of excess prices in an industry may properly be subject to tax, and to the extent of excess prices the tax will fall on all alike. But where excess profits are the result of individual initiative a tax on excess profits penalizes the manufacturer who from the standpoint of competition and ultimate lower prices should be encouraged.

Assuming that competitive conditions are normal and have brought prices on the average to a level where there is no more than a proper return to the industry as a whole, the manufacturer with profits above the average, and under an excess profit tax the highest tax, is the manufacturer who because of efficiency in design, buying, manufacture or distribution has the lowest cost, whereas the inefficient manufacturer with profits below normal pays no tax. You say that all the efficient manufacturer has to do is to reduce his price to a point where he will have to pay no tax. If he does this, it means stagnation as far as his business is concerned, because rapid, progressive growth and ultimate strength are only possible for the manufacturer whose profits are well above normal. Encouraging all such manufacturers will in the end force all other competitors to more efficient methods and average competitive prices to a lower level.

As a war measure and on the principle of taxing those most able to pay, the present excess profits tax is a proper measure, but as an indirect means of price regulation it is far from perfect. Personally, I am of the opinion that it is very much better for co-operating manufacturers to control the price problem from within under proper government supervision than to have it controlled from without by means of restrictive regulatory legislation.

Will Still Have Competition

I do not feel that any degree of co-operation will destroy those forms of individual initiative which are the basis of rational competition. We will still have the competition that is normally brought about by differences in and economy of designs, by quality, organization, energy, aggressiveness, executive ability, personality, sales policies and different degrees of efficiency in manufacture and distribution. We will also always have price competition; that is, as long as there are differences in design and in cost some manufacturers will be able to make lower prices than others, but they should be consistently lower, not that form of price competition which forces prices away down on some particular job or proposition where competition is severe, the loss to be made up either on other non-competitive products or on other jobs where there is no competition.

In undertaking a broader program there must be absolute frankness and sincerity of purpose, both in our relations with each other and with the government. Secrecy invites suspicion and distrust. If the object sought is in the interests of the business, we should have no hesitancy in taking the government into our confidence. Organized industry co-operating with the government is a far more hopeful picture than organized industry controlled by prohibitory legislation from an antagonistic, suspicious government.

I have not mentioned the co-operation which must be undertaken by this organization in the prosecution of the war, as this will be the subject of a separate report. In this we must give unstintingly of ourselves and of the full resources of our factories to the end that the government shall be supplied with what it needs in the shortest possible time.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

COST OF MANHOLES ON STREET-LIGHTING SYSTEM

Table Giving Details of Labor and Material, Transportation and Other Expense for Constructing Small Manholes

The data in the accompanying table show what it has cost the electrical department of Lincoln Park, Chicago, to construct 129 manholes of different sizes under various conditions. For purposes of analysis the costs have been divided into four classes, namely, labor, material, transportation and station expense. The latter item, which is taken as 15 per cent of the cost of the job, includes overhead and engineering charges. All of the holes, except those mentioned in the table as item No. 1, item No. 8 and item No. 11, were constructed with 24-in. (0.61-m.) round lawn covers of the locked type. The covers in the holes mentioned as items No. 8 and No. 11 were standard 28-in. by 32-in. (71.1-cm. by 81.2-cm.) street covers. As will be observed from the tabulation of "Conditions Encountered," the digging was comparatively easy in most places on account of the sandy soil. In some holes, however, buried rubbish was encountered, which somewhat added to the cost of excavation. Comparison of the total cost mentioned in item No. 11 with the other costs brings out quite clearly the extra expense involved in tearing up and replacing pavement. In this instance the pavement was placed on a concrete base, which further impeded progress and added to the cost. In item No. 1 the transportation expense seems to be out of proportion, but this item includes some cost which in other jobs is charged to labor, owing to the fact that a truck with a small crane on the rear end was used to assist in setting the frames and the concrete slabs which are used to cover the top of the brickwork and to act as a setting for the frame. The hole mentioned as item No. 8 appears expensive, and this is attributed to the fact that it was a special job. The costs in item No. 9 are interesting as showing the higher costs which rebuilding occasions.

DETAILS OF COST OF MANHOLE CONSTRUCTION UNDER VARYING CONDITIONS

Item No.	Number Holes	Date of Construction	Cost per Hole					Size of Hole	Conditions Encountered
			Labor	Material	Transportation	Station Expense	Total		
1	6	1916	$13.91	$17.32	$9.20	$6.06	$46.49	3 ft. by 3 ft. by 4 ft.	In lawn—frost in ground 3 ft.; sand, loam, rubbish, no paving
2	34	1916	9.56	16.97	.32	4.04	30.95	3 ft. by 3 ft. by 4 ft.	In loam—no paving, sand and loam, some sodding.
3	11	1917	6.40	11.71	1.41	2.93	22.45	20 in. by 36 in. by 42 in.	In lawn—sand, some sodding.
4	8	1917	8.93	14.31	1.99	3.80	29.03	3 ft. by 3 ft. by 4 ft.	In parking—sand and loam and rubbish, no paving.
5	11	1917	20.95	14.15	5.81	6.15	47.06	3 ft. by 3.5 ft. by 4 ft.	Same as No. 4.
6	6	1917	8.93	14.31	1.99	3.80	29.03	3.5 ft. by 3.5 ft. by 4 ft.	Same as No. 4.
7	8	1917	10.75	17.09	5.33	4.97	38.04	3 ft. by 3 ft. by 4 ft.	Same as No. 4.
8	1	1917	11.85	31.73	3.00	6.00	52.58	3 ft. by 3 ft. by 4 ft.	Same as No. 4.
9	7	1917	8.41	28.58	1.71	4.81	43.51	4 ft. by 5 ft. by 4 ft.	Same as No. 4—rebuilding job.
10	8	1917	8.57	27.09	2.88	5.78	44.32	3.5 ft. by 3.5 by 4 ft.	Sand and rubbish, no paving.
11	29	1917	25.38	29.58	5.04	6.00	66.00	3.5 ft. by 3.5 ft. by 5 ft.	Paving cut and repaving—heavy concrete base under asphalt and rubbish.
Grand average for total of the 129 manholes.....			$13.92	$19.43	$3.10	$4.84	$42.11	About 3 ft. by 3 ft. by 4 ft.	

CIRCUIT-BREAKER SIGNAL FOR HAND-OPERATED BOARD

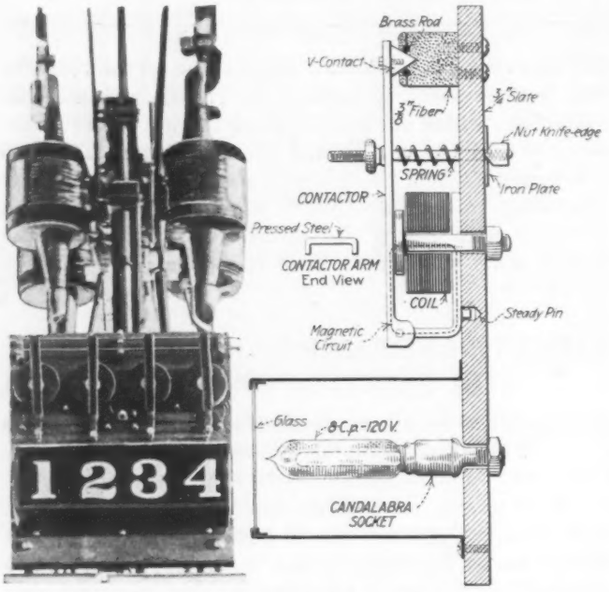
Device Used in Plant of Textile Mill Is Visual as Well as Audible—Reasons That Led to Its Installation

BY L. E. WOOD

It is usually the custom in power houses to provide some form of signaling so that the operator shall know when a circuit breaker has tripped. The accompanying illustration shows the device developed by the writer installed in a large textile plant in Canada.

The reason for evolving this device was as follows: The main switchboard of the plant in question consists of the feeder panels, twenty-two of which originally contained six triple-pole 100-amp. knife switches with fuses back of the panels. In modernizing the board, which became necessary owing to a large increase in load, the choice lay between scrapping the twenty-two panels and making use of such parts as could fit in with any scheme decided upon. After careful consideration it was decided to adopt oil circuit breakers, so that only the marble of the old panels could be uti-

lized, each allowing space for two 350-amp. C. G. E. type F oil switches. The switches, relays, ammeters and wattmeters were purchased and fitted to the old panels. The current transformers are so placed as to leave the back of the panels clear of all obstruction except switches, in addition to being in the direct line of the feeders, which pass through the ceiling. In installing the breakers some means of notifying the operator when the circuit was opened were necessary.



METHOD OF MOUNTING ON BOARD; DETAILS OF SIGNAL

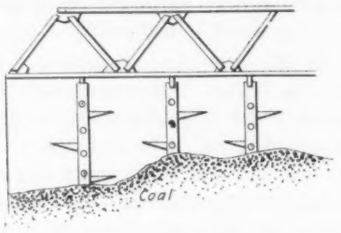
The signal device described here was made in the company's shop. A piece of slate ¾ in. by 15 in. by 16 in. (1.9 cm. by 38.1 cm. by 40.6 cm.) was used as a base, on which were mounted two 3/16-in. (4.8-mm.) brass rods threaded for two nuts and lug. At one end these were supported by pieces of ⅜-in. (9.5-mm.) thick fiber, fastened to slate base. Each slate base is suitable for four circuit breakers. A relay was made for each breaker, suitable for 120 volts direct current, the armature of which was fitted with V-contacts, so that when the coil was energized it short-circuited the two brass rods and so closed the signal circuit, operating a double 10-in. (25.4-cm.) gong supplied from a 110-volt, 60-cycle circuit.

MORE ACCURATE METHOD OF MAKING BUNKER SURVEYS

Simple Way Which Eliminates to a Certain Extent the Inaccuracy of the Existing Method of Estimating Coal Bunker Contents

BY H. WYGODSKY

Using the present common method of estimating the amount of coal in bunkers, considerable error may be made if the elevation of the coal is not measured in enough places and if the readings are inaccurate, as they may be in dark places. For this reason the writer suggests the following more accurate method. Pipes are arranged vertically in the coal bunkers at the points at which readings are to be taken and fastened to the overhead beams as illustrated here. At regular intervals along the pipe, say every foot, are placed markers, which should be in the form of projections instead of colored markers, as the latter will wear off or become covered with coal dust. To ascertain the amount of coal in the bunkers it is necessary only to count the number of projections visible on each pipe, calculate the average, and then refer to some table like those now used in most plants based on the ultimate capacity of the bunker when filled up to the level of the beam. The readings taken will represent the deviation of the surface of the coal from the level represented by the beam and will indicate how much should be subtracted from the ultimate capacity of the bunker. Old 4-in. (10-cm.) boiler tubes may be used for this purpose. When a



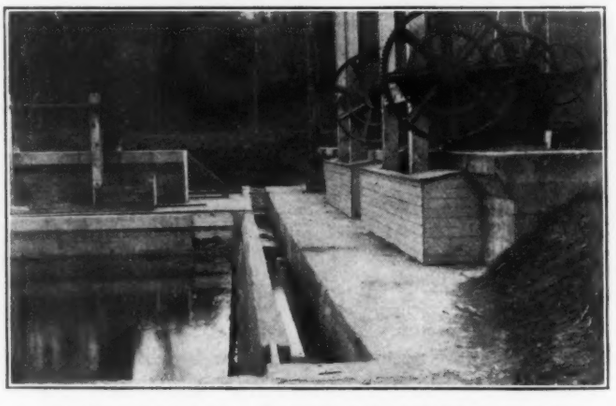
VERTICAL PIPES INSTALLED IN BUNKER

sufficient number of holes are provided in the pipes they may also be a great help in ventilating the coal, thus aiding in the prevention of fire in the bunkers. With a bunker of about 2700 tons (1830 t.) capacity and a top surface of 61 ft. by 75 ft. (18.6 m. by 22.9 m.) about fifty pipes should be installed to obtain accurate results.

SLUICE FOR CLEARING TRASH FROM RACKS

Channel Back of Tops of Racks Into Which Trash Can Be Raked and Sluiced Into River Below Plant

At the plant of the Central Massachusetts Electric Company in Palmer, Mass., which has recently been remodeled for improved hydroelectric service, a sluice has been provided for the removal of leaves and other



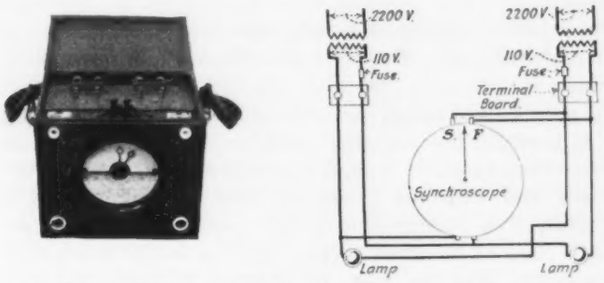
CONSTRUCTION OF CHANNEL FOR CLEARING TRASH

trash raked from the racks at the intakes. Behind the concrete structure at the top of each rack is a channel about 17 in. (43 cm.) wide and 24 in. (60 cm.) deep, with an outlet to the adjacent river. Wooden stop-gates of 2-in. (5.08-cm.) plank are provided at several points in the trash sluiceway to admit water from the forebay for flushing out the sluices.

PORTABLE SYNCHROSCOPE FOR TESTING AND PHASING

Outfit Built by a Western Company Is Equipped with Transformers, Lamp Receptacles and Synchroscope

To facilitate the testing and phasing out of transformers and lines a portable testing set has been made by the Puget Sound Traction, Light & Power Company



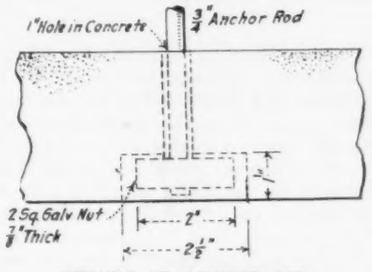
EXTERIOR VIEW OF PORTABLE SYNCHROSCOPE AND WIRING CONNECTIONS

of Seattle, Wash., by mounting two 2200/100-volt potential transformers and one Westinghouse synchroscope in a light oak box. A terminal board is provided on the low-voltage side to facilitate the attachment of a voltmeter, while two lamp receptacles permit the use of a light or dark lamp synchronizing connection. The box is constructed with a waterproof cover and porcelain bushings for the high-voltage and voltmeter leads. A sheet-iron cover slides in front of the face of the synchroscope to protect it from injury. This device was described by J. Hellenthal, general substation construction foreman of the Puget Sound company, at the recent annual meeting of the Northwest Electric Light and Power Association at Spokane, Wash.

ANCHOR ROD DESIGNED TO BE REMOVED UNDAMAGED

Square Nut Is Employed in Place of Regular Hexagonal Nut and Is Drawn Up Into Recess When Anchor Is Set

Where pole lines are extended or remodeled it is frequently necessary to abandon an anchor already installed. As an anchor rod usually protrudes a foot or



DETAILS OF ANCHOR ROD

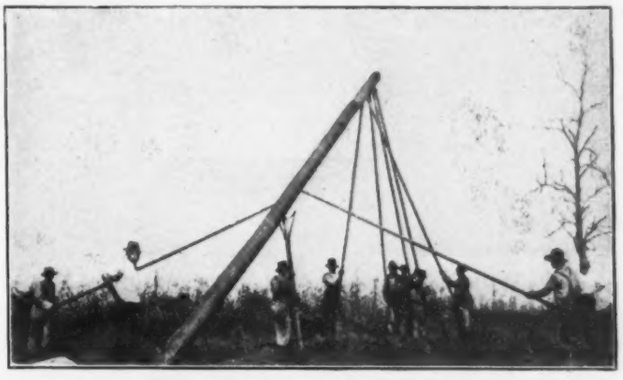
more above ground and would constitute a danger to pedestrians, its removal is essential. In order to avoid cutting off the protruding end, which is a waste both of labor and material, one company utilizes a scheme which permits releasing the rod and removing it undamaged. The anchor itself consists of a concrete slab or pyramid, and in the bottom surface, surrounding the hole through which the anchor rod passes, where the nut of the rod would naturally bear, a recess is cast into the concrete, 2½ in. by 2½ in. by 1 in. (6.4 cm. by 6.4 cm. by 2.54 cm.) deep. In the place of the ordinary hexagonal nut on the anchor rod a special square nut 2 in. by 2 in. by ⅞ in. (5.08 cm. by 5.08 cm. by 2.25 cm.) thick is employed. When the anchor is set the nut is drawn up into the recess. When it is desired to remove an anchor the rod is twisted, and as the walls of the recess prevent the nut from turning it unscrews and the rod may then be pulled out. With ordinary care used to see that the nut beds properly in the recess when the anchor is set, few cases will be found in which the anchor rod cannot be removed and saved.

SOUTHERN COMPANY SETS POLES AT 25 CENTS EACH

Gang of Twelve Men, Including Foreman, Set Sixty-eight Poles in a Day in Building Cross-Country Line

BY E. B. HOOK, JR.
Superintendent Construction Georgia Railway & Power Company, Atlanta, Ga.

The construction department of the Georgia Railway & Power Company, Atlanta, Ga., claims title to the record for setting poles, both for number of poles set



POLE ON "DEAD-MAN" READY TO BE "WALKED IN"

in one day and for minimum cost each. Recently a crew engaged in building a cross-country transmission line set sixty-eight 30-ft. (9.1-m.) creosoted pine poles in one day. This crew was composed of twelve men, including the foreman. The poles were piked in and tamped. The holes had been previously dug and the poles hauled in on the right-of-way.

Two of the crew preceded the pikers and placed the poles conveniently to the holes. The setting crew then lifted the top of the pole on to a "dead-man," took their position with their pikes and "walked it in," lined it and tamped it up.

The pay for this crew per day, including the foreman, is $17; therefore the cost of setting the poles was 25 cents each. Forty of the poles were set before dinner and only twenty-eight in the afternoon. This was on account of a drizzling rain which set in about midday and handicapped the work to some extent and also caused darkness to come about a half hour earlier than usual. If the weather had been clear all day, the men assert they would have set at least seventy-five poles and possibly eighty.

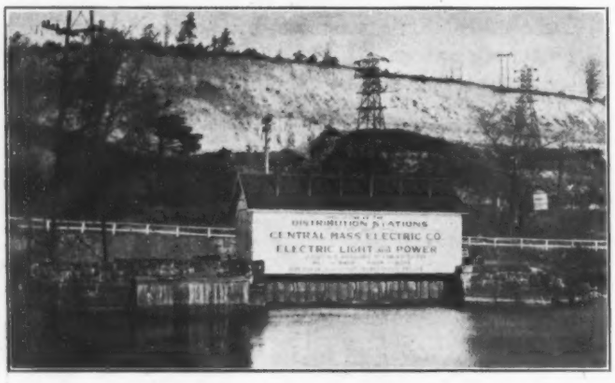
CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

ADVERTISING ELECTRIC SERVICE ON GATEHOUSE

Massachusetts Property Uses Building Well Situated Along Steam and Electric Lines and Close to Automobile Highway

Effective publicity for electric service is secured by the Central Massachusetts Electric Company at its generating plant and substation in Palmer, Mass., as shown herewith, by an advertisement of the facilities of the system on a gatehouse at the entrance of the local forebay. The gatehouse stands between the Boston & Albany Railroad and the Worcester-Springfield interurban electric line, so that by "signing" both sides



MAKING USE OF AN ADVERTISING OPPORTUNITY

of the building every passing car comes within range of this effective publicity. A main automobile highway between Springfield and Boston also passes the plant close by the gatehouse.

FOSTERING THE INITIATIVE OF EMPLOYEES IN SMALL TOWNS

Practice of Paying Straight Salary Declared to Be Wrong, as It Robs the Man of Incentive to Do More Than Just His Job

The vice-president of an electric light and power company operating in a number of small and medium-sized cities in the Middle West recently advanced the opinion that paying men on a straight salary basis was about as poor a plan of payment as could be worked out for companies of the character with which he is familiar. Taking the case of the local manager of one of his own towns, for example, he analyzed the situation as follows: "Suppose I hire a man as local manager for D——. When I send the man out to this small town I tell him to endeavor not to absorb the easy-going lackadaisical spirit of the small town. I tell him to try to live above that plan and, even though every other merchant in the city sits in his place of business and waits for business to come to him, to get out and do a little hustling and make everybody see that he is a real live wire. Now if I should send him down with those instructions and with the assurance that he will be paid a fixed salary, instructions may carry him along for a while, but the effect will not be permanent. On the other hand, if I send him down with the instructions and with the assurance that he will be paid a certain fixed salary plus a commission on all of a certain class of business turned in, it is pretty much of a certainty that the man, in addition to doing his job, will put in some extra hours endeavoring to close up the class of business which will bring him a commission.

"Our local managers are paid from $75 to $150 a month. In addition to this they are usually given an opportunity to earn about $1 per horsepower connected on all new power business turned in. Power business was selected as the particular class of service upon which we should pay commissions in our towns, since there was great need of building up the day load. We do not have this plan working as smoothly as we should like in all places, but in the main it has been found that it keeps the small town employees more interested in themselves and in the welfare of the company."

ILLUMINATING ENGINEERING AS A COMMERCIAL FORCE

Threefold Actual Basic Commercial Purpose of the Illuminating Engineer on Central Station Industry Outlined

In a paper prepared under the auspices of the lighting sales bureau of the National Electric Light Association by O. R. Hogue, C. L. Law and E. E. Whitehorne, for the 1916-17 correspondence convention of the Illuminating Engineering Society, attention is directed toward illuminating engineering as a commercial force. In developing this idea the authors said:

There is a great deal of unfortunate misunderstanding as to the commercial purpose and practical value of the science of illuminating engineering to the lighting industries. Its laws and principles have been discussed and analyzed through years of evolution, its practices have been defined, its ever-growing wealth of experience has been related and passed on for wider use, but men have kept on thinking of it largely as a scientific propaganda. The most important fact remains that this same science of illuminating engineering has marshaled to the service of the central station, gas or electric, a great creative force for the development of further bigger, better business in the lighting field.

It is because this fact has not been generally recognized with the enthusiasm it deserves and generates once the idea is grasped that we see so many central stations and so many gas-lighting companies still going on without any real effort to treat their lighting business seriously. They seem to be content to sell just light—the raw material—instead of accurate illumination as the finished product. Yet we know well that by the systematic application of

illuminating engineering the profits of such lighting business can be immeasurably increased as has been proved in the experience of many cities.

It is worth while, therefore, to consider what really are the actual basic, commercial purposes of illuminating engineering in the central station industry, for instance. There are three purposes:

1. To help develop new lighting business by converting new customers to the use of electric light.

2. To improve the lighting of present customers and increase its usefulness and value to them, and in this way gradually to raise the standard of illumination throughout the community and thus automatically to increase the company's lighting business.

3. To promote the satisfaction of present customers by giving them better service and more effective lighting that will tend to make them regard more highly the influence and benefits of good illumination, and in this way ultimately to win for the company a greater popularity in the community.

The paper then went into the details of how illuminating engineering departments work in a few cities of different size.

PRESENT VALUE OF LIGHTING AND APPLIANCE BUSINESS

Attractive Publicity, Intelligent Solicitation, Honest Advertisements and Service Required to Secure Maximum of This Business

BY THOMAS ROBSON HAY

In a great many localities central station growth has been of the mushroom variety, and this is especially true of the last two or three years. Power requirements have grown in an unprecedented manner, due principally to the erection of new plants and to the enlargement of existing plants to take care of increasing requirements. On account of the increasing cost of machinery and fuel, together with intelligent and active solicitation, a large portion of this business has been secured by the central stations. The purchase of the needed power has facilitated and expedited the commencement of operations; has reduced delays due to power plant troubles, with the consequent loss of production; has economized in the use of labor—a very important consideration at this time—and has relieved the management of the necessity of providing a continuous supply of fuel. By the purchase of electric power from the central station the entire boiler and engine-room force can in most cases be eliminated and the men released for employment elsewhere in the factory or outside. Furthermore, all new plants are modernized as to power application, machine lay-out, etc., and put in such shape as to enable minimum production costs for the different conditions of operation. Non-delivery of coal in sufficient quantities and at high prices becomes no longer a troublesome factor of operation to the mill, and any delays or inconvenience on account of gas shortage—when gas might be used—are thereby obviated.

At normal prices for fuel, labor and materials, the present industrial conditions as regards the central station would be desirable, as many of the plants are operating on a twenty-hour to twenty-four-hour production schedule, thus making for a relatively high central station plant load factor. Under the existing abnormal condition, however, the situation is anything but pleasing from a net income point of view, as fuel costs, the largest single item entering into the production of electricity, have in many cases increased two or three times, with labor and materials likewise considerably higher.

NEED FOR INCREASED CENTRAL STATION RATES

All central stations are required to sell energy for electric light and power in accordance with published schedules of rates, and in most states are allowed to change these rates only on approval by the state commission. So far as the central stations are concerned, these published schedules of rates were deemed satisfactory two or three years ago. The abnormal increases in the cost of raw materials, such as fuel, copper, labor, etc., entering into the production of electricity, besides overhead expenses, have so increased the cost of their production that, in spite of the large increase in gross income, unless the central stations are permitted either to raise their rates or to make some additional charges per unit—especially as regards increased fuel costs—net earnings and the working surplus will be very materially decreased. If continued for any length of time, this condition will, of course, affect adversely the amounts available for improvements and extensions and for the payments of dividends and, in the end, will tend to bring the central station into a condition where the vast amount of new capital required will not be available except at what are practically prohibitive rates. It is not to be presumed that the present condition as to production and delivery costs will continue, and, although in normal times the net income of the average well-managed central station is adequate, it would yet seem that in order properly to meet unusual conditions the incorporation of a "coal clause," based on increased cost above a certain base price, should be a permanent part of central station policy, at least as regards wholesale power rates.

In view of the present conditions mentioned as obtaining in the industry the present would seem an opportune time to redouble efforts to increase the sale of electricity for house lighting and for the operation of the various appliances that are on the market. This class of load is of special value in helping to flatten out the station load curve, particularly for the smaller operations. Such business has a high revenue return and will in many cases not only act to increase the net return from all connected business but will also be an active agent in further popularizing the use of electricity, particularly among the laboring classes, who are now earning more than ever before and consequently have more to spend. They will feel more able to make the expenditure for house wiring and fixtures and appliances than would have been the case several years ago, and the service, once in, will be used for as long as the particular property is occupied. But in order to secure this business the prospective customer must be convinced that he will be justified in making the expenditures and that the expenditures once made will be a good investment.

FOUR THINGS NECESSARY

In order to secure this business four things are necessary: (1) Attractive and appealing publicity; (2) intelligent solicitation; (3) delivery of goods as advertised; (4) service.

1. Perhaps the most effective way of advertising is by means of newspapers. The copy ought to be attractive and informing. To be effective, it must be well written, must be truthful as to statement of fact, and,

when illustrated, the cuts must be vitalized with action and suggestion—not stereotyped by the use of uninteresting illustrations lacking any suggestion of comfort, convenience and utility. Too little printed copy is better than too much. Technical expressions are better eliminated, for always must the public that it is especially desired to reach be kept in mind.

2. Intelligent solicitation means, first of all, preparing and mapping out a fairly definite and comprehensive plan of procedure. By means of records or on the advice of the salesmen, if no records are available, each man's quota can be determined and the particular line of goods to be pushed can be allotted to each district. In the districts inhabited by the laboring people house wiring and then the sale of inexpensive appliances, such as fixtures, irons, toasters and the like, can be concentrated on. In the better residence districts more expensive appliances, such as washing machines, vacuum cleaners, lamps and the like, can be pushed. By assigning quotas the approximate gross sales can be determined, and from this information the prices at which the articles may be sold can be arrived at and some idea of the possible volume estimated.

By proper standardization of the different classes of houses to be wired as to rooms and then as to outlets, labor and materials, a fairly low cost can be realized and a quick turn-over of labor and material obtained.

3. It is essential that all goods be delivered and all sales or special offers be conducted exactly as advertised. Such action acts to establish firmly the integrity and honesty of the company and of its employees and vindicates the truth of all statements made or implied. The principal consideration is not only that the company shall establish itself as an integral and respected member of the community but that, as a result of its reputation, it shall be able to reduce the cost of selling and of overhead, thus making possible a lower cost to the buyer or consumer without diminishing the net profit to the company. Sales that are made by advertisements, by the circulation of printed matter and by the company's reputation are much less costly than those that are personally solicited and are indications of right relations between the public and the company.

4. Above all, the utility must sell service. By intelligent publicity and service a community can be so educated to use electricity in its different applications that a large number of sales will be made automatically and the effect of competition be reduced to a minimum. Never should the impression be conveyed in advertisements or by the statement of representatives that something is being offered for nothing, as the value of the product is thus apt to be depreciated in the eyes of the public and the company, and all that is otherwise offered is apt to be regarded in a less favorable light than might otherwise be the case. The use of premiums is, of course, a different matter, but it should be always made clear that the premiums are awarded for a tangible and real consideration.

Making "Boosters" Out of Customers

When a customer has been secured his contract should be fulfilled at the earliest possible date, and all goods purchased must be promptly delivered as agreed. If the making of a connection is delayed and if a house cannot be wired so promptly as the customer thinks it ought to be, intelligent explanation by the salesman or by the office man will usually act to account satisfactorily for the delay and to keep the customer in a friendly and tolerant attitude. Always it should be the function of the company to convert each individual member of the community into a friend and a "booster" for all things electrical, instead of having him as a "knocker" and an enemy. Where dissatisfied customers are located, or where individuals in a community are found who insist on "knocking" because of a real or fancied grievance or because of a generally hostile attitude toward the company, these individuals should be sought out, their story solicited and a reasoning and logical argument presented to overcome objections offered, so that the "knocker" may be converted into a friend and a "booster." An electric light and power company, to become a real and vital force for community welfare, must be a public servant in the broadest sense of the word, and must enter into the community life as a progressive and honest force having the interests of the community uppermost. In serving the public and its interests the company is equally benefited and its right to existence is justified.

PROPORTIONS FOR GENERAL AND LOCALIZED LIGHTING

Ohio State University Tests Show Preponderance of Choice for 40 per Cent Localized and 60 per Cent General Lighting in Combination

Results of a test made at the Ohio State University to determine what are the preferred proportions in combining general and localized lighting were given by Prof. F. C. Caldwell on Nov. 15 before the Chicago Section of the Illuminating Engineering Society. The paper presented by Professor Caldwell at this meeting is also to be presented in the 1916-17 correspondence convention of the Illuminating Engineering Society by Professor Caldwell and W. M. Holmes. Important excerpts from the paper follow:

The solution of the problem involves so many factors that it would probably be impossible to find a ratio which could be universally applied. A step in this direction, however, has been taken by working out one or two definite cases where the conditions are made simple and are carefully defined. While the results obtained from such an investigation hold only for the assumed conditions, they may serve as an indication of probable requirements for other and more complex cases.

The conditions of the test were as follows: The test took place in a small room with a white ceiling and very simple dark-colored furnishings; the general lighting was obtained entirely by reflection, the localized lighting from a table lamp with opaque reflector and diffusing glare. One hundred observers expressed their preference, from which and for the conditions described the following conclusions are drawn:

1. With light ceiling and dark walls and throughout a range of foot-candle intensities on the work from 2 to 6, about 40 per cent of localized and 60 per cent of general lighting is preferred.

2. Within the above range this ratio is not materially affected by the intensity of illumination upon the working plane.

3. This ratio is approximately the same for men and women.

4. Changing the walls to a light color does not greatly affect this ratio.

5. For the above preferred proportions of direct and indirect light and with dark walls the ratio of the brightness of the ceiling to that on the working plane lies between 2.5 and 3.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Lamps and Lighting

A Combination of Refractor and Diffusing Globe for Street Lighting.—WARD HARRISON.—The author points out that for many years the general trend of development in arc lamps has been toward increasing the relative proportion of light flux emitted in zones near the horizontal and that the use of high-efficiency incandescent units with refractors makes it possible to direct the light where it is most needed. By means of a refractor one can more than double the normal candlepower of the lamp at angles near the horizontal and thus increase the intensity midway between units, at which point the illumination is usually not more than 5 to 10 per cent of the average over the street surface. The opal globe is deficient in revealing smaller obstacles or irregularities in the road surface throughout an extended region midway between lamps. A disadvantage of every form of street-lighting unit is that in the absence of most rigid inspection and maintenance the efficiency of the system becomes rapidly impaired from the collection of dust and grime. The author illustrates and describes in this paper a type of unit which has been developed in order to combine in one fixture the advantage of both the opal globe and the refractor, to improve the appearance of the source when lighted and to minimize the depreciation due to dirt. Communicated discussions are given with this article. —*Transactions* Illuminating Engineering Society, Oct. 10, 1917.

Generation, Transmission and Distribution

Plotting Blower-Test Curves.—A. H. ANDERSON.—To the several methods of plotting blower-test curves another method is contributed by this author, its utility being demonstrated by the solution of problems from graphically recorded test data. Diagrams are given for impellers with blades tilted forward, with blades radial, and with blades tilted backward, the co-ordinates used being revolutions per minute and static pressure in inches of water. Two series of curves are given, one showing various rates of discharge in cubic feet per second and the other the volumes discharged per second per horsepower.—*Journal A. S. M. E.*, November, 1917.

Economic Steps Taken by Vienna Electric Service Company.—The operation of municipal electric systems in Vienna during 1915-16 was influenced to a considerable degree by the necessity of surrendering large amounts of lead and copper to the war department. In addition, it had to reduce the operating expenses and get along without materials which are scarce and unavailable. Considerable metal required by the war department has been made available by interconnecting plants and dispensing with the smaller ones, thereby allowing the utilization of considerable metal represented by the old equipment. A number of the large storage batteries in various substations were turned over to the government so that the lead could be recovered. This was done under the condition that the electricity works were to receive within a year after the signing of peace new storage batteries to take the place of the old ones without charges of any kind. One station was able to turn over a large amount of materials, including old wire and conduit, to the war department by rearranging its switchboards more efficiently. Metal was released in another station by transforming from a steam plant to a transformer station. Owing to the commandeering of all lead and copper for the war department, distribution systems have not been extended much. Whatever had to be done in the line of opening new connections was permitted by changing branch lines. In a number of cases where cables of large cross-sections were taken out of service they have been cut up in lengths of about 100 m., stripped of insulating material and sheathing, and the copper wires unwound, straightened and cleaned and finally redrawn into smaller wires.—*Elektrot. und Maschinen.*, September, 1917.

Traction

Operation of Railway Substations Without Attendants.—W. D. BEARCE.—The author gives a brief historical review of the progress made during the past three years in the equipment of automatic substations for railway service. While about thirty automatic railway substation equipments are under construction at Schenectady, the following description is mainly confined to railway systems which are now actually operating attendantless substations.—*General Electric Review*, November, 1917.

Regenerative Braking.—WALTER V. TURNER.—The returning of energy to the line, permitted by regenerative braking, is generally the least important advantage when considered from the standpoint of the possible total economy, which includes the saving of time, the reducing of wear and tear on the brake shoes and wheels, and the reduction of heating of shoes and wheels. Furthermore, with regenerative braking the speed of the trains can be kept much more uniform than when airbrakes are used alone. The joint use of both brakes possesses the advantage that more tonnage per day can be hauled down grades and higher speed can be permitted, with a safety factor equal to that obtained at present with the airbrake alone. The author calls attention to the necessity of some interlocking arrangement between the regenerative brakes and airbrakes so that the airbrake cannot be applied while the regenerative brake is in use, and he suggests a scheme that can be used in order to attain this object.—*Electric Journal*, October, 1917.

Operating Experiences on the Philadelphia-Paoli Electrification.—LAURENCE M. WILSON.—Some of the experiences that have been passed through with this

equipment are outlined. Among them are the elimination of trouble from sleet collecting on the pantagraph tubing, a method of splicing pantagraph tubing, a method of keeping snow out of the transformer windings, changes that were made in the insulation between the main and auxiliary field windings to prevent breakdown between these two circuits, a method of providing additional starting torque, the elimination of resistors during acceleration to reduce energy consumption, and provision of a series transformer in the lead from the pantagraph to lower the latter in case of a short circuit such as a ground in the high-tension winding of the transformer.—*Electric Journal*, October, 1917.

Transformer Conduction Motors.—R. E. HELLMUND. —The author explains in a relatively simple manner the working principles of transformer conduction motors such as are used in the suburban service of the Pennsylvania Railroad at Philadelphia.—*Electric Journal*, October, 1917.

Installations, Systems and Appliances

High-Tension Insulators.—After indicating the electrostatic formulas which serve as the basis of his theory, the author traces the equipotential lines and the lines of force around a conductor charged to a certain potential and surrounded by a metallic plate connected to ground. If the conductor is surrounded by a dielectric other than air, account must be taken of the laws of refraction for lines of force and equipotential lines. Varied examples help in the comprehension of the method, and conclusions are drawn not only from the point of view of the form that should be given to insulators but also concerning the composition of the insulating material, which may perhaps be constituted of many substances of specifically different inductive powers.—*Revue Gén. de l'Elec.*, Oct. 27, 1917.

Annealing and Heat Treating of Steel and Melting of Non-Ferrous Metals in the Electric Furnace.—T. F. BAILEY.—The author gives some of the important uses to which car-type annealing furnaces, continuous pusher type furnaces, automatic heat-treating furnaces and brass-melting furnaces have been applied. As there seems to be no real necessity for the use of a crucible excepting in the melting of precious metals, and because of their high cost, rapid destruction and the necessity of handling small quantities of metal with attending high labor charge when they are used, the tilting-hearth-type furnace was developed. This type of furnace was first used for aluminum and aluminum alloys, and later the same type with slight modifications in the details was used for pouring brass. This furnace, with a normal rating of 105 kw. and a melting capacity of 600 lb. (272.2 kg.) per hour, has melted the following materials and superheated them to a suitable pouring temperature with an average condition as noted: New red brass—85 per cent copper, 15 per cent tin, 400-lb. (181.4 kg.) heats in one hour, with 90 kw.-hr., or 450 kw.-hr. per ton; scrap yellow brass (case I)—72 per cent copper, 28 per cent zinc, 750-lb. (340.2 kg.) heats in one hour ten minutes, with 120 kw.-hr., or 320 kw.-hr. per ton; (case II), 70 per cent copper, 30 per cent zinc, 800-lb. (362.9 kg.) heats in one hour eighteen minutes, with 110 kw.-hr., or 275 kw.-hr. per ton; brass chips and borings—70 per cent copper, 30 per cent zinc, 700-lb. (317.5 kg.) heats in two hours thirty minutes, with 220 kw.-hr., or 720 kw.-hr. per ton. Much lower current consumptions have been made in individual heats, but the above are the averages of several heats of each metal melted. The author points out that of all the electric furnaces of the types described now developed the tilting-type furnace is the one permitting the greatest saving in cost over fuel-fired furnaces of any type, whether fired with oil, gas or coke, as the metal loss is lower and the crucible cost is eliminated entirely, while the labor item is less on account of size and convenience of operation. The following figures may be safely taken as operating conditions with yellow brass in a shop operating twenty-four hours per day:

	Per Ton
Electricity, 400 kw.-hr. per ton, at 1 cent	$4.00
Metal loss, 1 per cent zinc, at 10 cents per lb.	2.00
Labor, one man per hour per 600 lb., at 36 cents per hour	1.20
Renewals and repairs	1.00
Total per ton of melt	$8.20

A discussion of this paper is also given.—*Journal of the Cleveland Engineering Society*, September, 1917.

Electrochemistry and Batteries

Notes on the Electric Storage Battery.—EDWARD WANTON SMITH.—A review of the theory of operation, construction, performance and uses of nickel-iron-alkaline and lead-acid storage batteries.—*Proceedings* of Engineers' Club of Philadelphia, September, 1917.

Miscellaneous

The Coal Problem in Argentina.—In spite of all that railroads and industries have done to replace coal by other combustibles, the fuel problem in Argentina grows daily more acute. Unless public service companies are able to import coal, in a short time they will be affected in a manner prejudicial to the public interest. This is especially true of the lighting companies, both electric and gas, which are about to ask permission from the authorities, as the railroad companies have already done, to increase their tariff, possibly by 25 per cent. Coal has risen in price from between $13 and $14, the pre-war figure, to more than $40 a ton, while the government charges more than $90 a ton for the state-owned petroleum, or nearly four times the normal price.—*La Electricidad y la Maquinaria*, Buenos Aires, Sept. 30, 1917.

Critical Speeds of Loaded Shafts.—W. M. WALLACE. —This article describes experiments that were conducted for the purpose of testing the accuracy of various simple methods of determining the whirling speed of a shaft of variable section and the effect of radial clearance at the bearings on the whirling speeds.—London *Engineer*, Sept. 21, 1917.

Unification of Frequencies in Italy.—No less than five frequencies now exist in Italy, so the Italian Electrotechnical Association is planning a campaign to standardize frequencies. Forty-two-cycle is in the lead as regards actual territory covered, being used in nearly all the north provinces and to some extent in the south. Fifty-cycle, however, is a close second, prevailing in Turin, Genoa, Milan, largely in the center and south of the peninsula, and in Sicily and Sardinia. In the districts around Rome 46-cycle energy is used, and throughout the country there are isolated 16-cycle and 25-cycle installations.—*L'Elettrotecnica*, Oct. 15, 1917.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ORGANIZATION MEETING OF WAR SERVICE COMMITTEE

Clarence L. Collens, II, Appointed Temporary Chairman and W. W. Nichols Temporary Secretary at the Preliminary Gathering

At the organization meeting of the war service committee of electrical manufacturers in New York on Nov. 28, as mentioned briefly in last week's issue of the ELECTRICAL WORLD, Clarence L. Collens, II, was appointed temporary chairman and W. W. Nichols temporary secretary. The committee discussed at length ways and means of doing the work for which it was created. It also considered the appointment of committees to facilitate its activities. The war service committee is composed of two representatives each of the Associated Manufacturers of Electrical Supplies, the Electric Power Club and the Electrical Manufacturers' Club.

The resolution passed at a recent meeting of the Electrical Manufacturers' Council, under which a war service committee is being appointed, says:

First—That there be appointed a committee of six to be known as the general war committee of the electrical manufacturing industry.

Second—That such committee be appointed by the Electric Power Club, the Electrical Manufacturers' Club and the Associated Manufacturers of Electrical Supplies, two members being named by each.

Third—The functions of such committee to be: (a) to determine the needs of the government for electrical material under prevailing conditions; (b) to establish such connections with the various agencies of the government as will insure continuous information as to such needs; (c) so to organize the industry through specific or emergency committees as will insure the meeting of governmental requirements for material or information; (d) to transmit to the government the needs of the industry to the end that the government's requirements may be met speedily, efficiently and with the minimum of industrial disturbance.

Fourth—That this committee be empowered to hire such assistance and make such expenditures as may be necessary properly to accomplish said functions, and that such expenditures be assessed equally upon the three organizations herein mentioned.

ELECTRIC POWER CLUB WAR SERVICE COMMITTEE

Data Will Enable Electrical Division of the War Industries Board to Improve Its Service to the Nation

The electrical division of the War Industries Board of the Council of National Defense has issued the following bulletin, dated Dec. 1:

The war service committee of the Electric Power Club convened in Washington on Nov. 24; after reviewing the needs of the government and our allies, it determined upon a survey of the industry. The data collected will be brought to Washington for co-ordination at the second conference to be held early next week. With the data proposed this department will be in position to handle inquiries much more efficiently than at present.

The loan of experts for assistance was arranged for, and it is expected that with a department of sufficient personnel needs of the government can be directed toward the companies in best position to satisfy those needs in the time required.

Our duty is to assist the government, but, indirectly, we shall be assisting the government if we assist you when needed in your own individual problems. We place our services freely at your disposal in so far as your difficulties concern your production for war needs.

You will be interested to know that the War Industries Board has under discussion plans for supplying material for manufacture for stock articles, which will in turn be drawn from stock for war needs. The problem is a general one affecting industries other than ours.

WAR SERVICE COMMITTEE OF ASSOCIATED MANUFACTURERS

Conference of Chairmen and Representatives of Sections of Associated Manufacturers of Electrical Supplies—Meeting Set for Dec. 13

To further the organization of the general war service committee of the electrical manufacturing industry, a meeting was held on Dec. 3, at the offices of the Associated Manufacturers of Electrical Supplies. It was called by request of R. K. Sheppard and J. R. McKee, the representatives of the association on this committee.

There were present the following chairmen and representatives of the various sections in the association:

J. R. McKee, General Electric Company.
R. K. Sheppard, Simplex Wire & Cable Company.
E. Whitmore, Manhattan Electrical Supply Company.
J. E. Way, R. Thomas & Sons Company.
R. W. Seabury, Boonton Rubber Manufacturing Co.
E. B. Hatch, Johns-Pratt Company.
J. H. Trumbull, Trumbull Electric Manufacturing Co.
C. L. Eidlitz, Metropolitan Electric Manufacturing Co.
W. D. Steele, Benjamin Electric Manufacturing Co.
D. H. Murphy, American Conduit Manufacturing Co.
C. O. Baker, Wheeler Reflector Company.
H. R. Sargent, General Electric Company.
J. C. Dallam, General Electric Company.
H. W. Bliven, Harvey Hubbell, Inc.
A. F. Chamberlain, Robbins & Myers Company.
C. E. Corrigan, National Metal Moulding Company.
J. B. Adams, Irvington Varnish & Insulator Company.
Russel Dart, Alphaduct Company.

Mr. Sheppard and Mr. McKee explained at length the position in which the government was placed and what it desired to accomplish through the manufacturers of the association. After an extended discussion it was decided to hold a meeting of all the executive and associate members of the association at Delmonico's, New York, on Dec. 13, at 10 a. m., after which meetings of all sections will be held to appoint representatives to co-operate with the general war committee of the electrical manufacturing industry.

CALIFORNIA TO STUDY THE OPERATION OF UTILITIES

War-Time Survey by State Railroad Commission to Cover Ways and Means for Increasing Efficiency of Hydroelectric Systems

The California Railroad Commission has instituted investigations into the maintenance of railroads and possible economies in operation and the construction and operation of electric and gas utilities during the war.

In co-operation with corporations affected, the commission will survey railroad, electric and gas industries to discover, if possible, ways and means for decreasing expenditures and increasing the aid which these companies can give the federal and state governments. The commission will endeavor to provide for fuel conservation, manufacture by gas companies of by-products for war use, raising efficiency of hydroelectric concerns, making railroads most serviceable.

Commissioner Max Thelen will conduct the gas investigation beginning on Dec. 8, Commissioners Harvey D. Loveland and Edwin O. Edgerton the railroad investigation, with a hearing on Dec. 14, and Commissioner Frank R. Devlin the electric utilities investigation, beginning on Dec. 10.

ELECTRIC AID FOR THE CANADIAN VICTORY LOAN

Dynamo Temporarily on the Plaza in Ottawa Shows the Mounting Totals of the Subscription in that City

A. A. Dion, general superintendent Ottawa Electric Company, shows a striking use of electrical equipment in that city to aid the successful sale of Canada's Victory Loan. The accompanying illustration of a temporary installation on the "Plaza" in Ottawa indicates the way in which the electric company co-operated.

ELECTRICITY HELPS CANADA'S LIBERTY LOAN

The dynamo was kept in motion by a small motor within the base. At night it was illuminated. The half circle on the top showed, by means of the pointer, the number of millions subscribed in Ottawa from day to day. The pointer was kept vibrating constantly so as to attract attention and make it look like a voltmeter when the voltage was a little unsteady. A "registration book" 20 ft. (6 m.) high formed part of the plan.

COAL OPERATORS ASKED TO FOLLOW PRIORITY PLAN

Requests of Federal Fuel Administrator Provide for Preferential Shipments for Thirty Days—Position of Utilities

Requests to coal operators issued by the United States Fuel Administration on Dec. 2 established the order of preference in which coal needs are to be filled. The requests, directed to about 5000 producers, provide for preferential shipments for thirty days.

The following request was directed to all operators in Ohio, Michigan, Kentucky, Illinois, Indiana, Alabama, Tennessee, Colorado and Oklahoma:

> Subject to compliance with orders heretofore issued by the Fuel Administration for preference in shipments for certain specified purposes, the Fuel Administration requests that you give preference in shipments for the next thirty days on government orders, railway fuel, domestic requirements, public utilities and munition plants.
>
> It is necessary in the present situation to give preference in shipments as requested, and we solicit and thank you in advance for your co-operation in this direction.
>
> We will appreciate it if you will advise the Fuel Administration of any free tonnage you have available which we may call on you to ship for emergency requirements.

All operators in Pennsylvania and Kentucky were requested in a similar form to give preference in shipments for the next thirty days on "government orders, railway fuel, domestic requirements, public utilities, steel plants, by-product coke ovens and munition plants."

All operators in West Virginia and Virginia were requested to give preference to shipments for thirty days on "government orders, railway fuel, tidewater shipments for New England, domestic requirements, public utilities and munitions plants."

The requests cover practically all of the coal production of the country outside of the Rocky Mountain coal districts. The Rocky Mountain output is largely consumed in localities where it is produced.

TWO-YEAR NOTES SOLD BY BOSTON EDISON COMPANY

Issue of $3,000,000 of 6 per Cent Securities Quickly Absorbed by Public at Price Yielding About 6.65 per Cent Net

An issue of $3,000,000 of two-year 6 per cent notes, dated Dec. 1, has been sold by the Edison Electric Illuminating Company of Boston to Lee, Higginson & Company, Old Colony Trust Company, F. S. Moseley & Company, Parkinson & Burr and Kidder, Peabody & Company. The notes were offered to the public at 98¾ and interest, to yield about 6.65 per cent, and were sold very quickly. It is stated that with normal conditions of extension this will meet the capital requirements of the company to the middle of 1919.

POOL IN COAL SHIPMENTS PUSHED FORWARD IN OHIO

Pending Completion of New Arrangements Central Stations Run Dangerously Close to Depletion of Fuel Supply

The plan for pooling coal shipments outlined in the ELECTRICAL WORLD of Nov. 24, 1917, was completed at a meeting of coal operators, railroad representatives and coal administrators of Ohio, Pennsylvania and West Virginia in Cleveland. Operation of the plan has been intrusted to a committee of seven operators in Ohio, Pennsylvania, West Virginia and Kentucky. Pooling points for the present will be at Cleveland, Cincinnati, Columbus, Toledo, Canton, Akron, Pittsburgh and Detroit.

Revocation of the government priority order, which has been sending about 5,000,000 tons of coal monthly to the upper lake country, will release this amount. This, with the pooling plan, it is thought, will relieve the shortage which has existed for several months in the states concerned.

Both the Cleveland Electric Illuminating Company and the Cleveland municipal light plant have had very narrow escapes. Their coal supply was almost exhausted, but small shipments arrived in bare time to prevent a partial closing down.

The Northern Ohio Traction & Light Company, Akron, was compelled to withdraw service from a number of industrial plants temporarily on Nov. 27 because of fuel shortage. General Manager A. C. Binn said that the supply would last four days and that effort would be made to continue operation of the electric railway and to furnish street lighting for Akron. By conserving supply through restriction of service he thought that it might last until shipments should improve the situation.

Until recently coal has been confiscated regularly in some parts of Ohio. The situation in northwestern Ohio was particularly acute, and at Delphos it was necessary to confiscate fifteen cars of coal in fifteen days. H. W. Brunell, Northwestern Ohio Light Company, assisted by the Mayor and Chief of Police of Delphos, participated actively in this work to keep industries, some of which are engaged in government work, supplied with electric power. In some cases it was necessary for these men to operate railroad locomotives in order to get coal cars cut out of trains and on the electric light company side track.

PRESIDENT WILSON'S ADDRESS

The main part of the address of President Wilson to Congress on Dec. 4 was devoted to his powerful arraignment of "the masters of Germany," to his account of the circumstances that require a declaration of war against Austria and to his outline of just conditions necessary to righteous peace. There were also references to business, as follows:

WATER-POWER DEVELOPMENT IMPERATIVE

It is imperatively necessary that the consideration of the full use of the water power of the country and also the consideration of the systematic and yet economical development of such of the natural resources of the country as are still under the control of the federal government should be resumed and affirmatively and constructively dealt with at the earliest possible moment. The pressing need of such legislation is daily becoming more obvious.

PERMIT EXPORTERS TO COMBINE

The legislation proposed at the last session with regard to regulated combinations among our exporters, in order to provide for our foreign trade a more effective organization and method of co-operation, ought by all means to be completed at this session.

GO FURTHER IN PRICE-FIXING

Recent experience has convinced me that the Congress must go further in authorizing the government to set limits to prices. The law of supply and demand, I am sorry to say, has been replaced by the law of unrestrained selfishness. While we have eliminated profiteering in several branches of industry, it still runs impudently rampant in others. The farmers, for example, complain with a great deal of justice that, while the regulation of food prices restricts their incomes, no restraints are placed upon the prices of most of the things they must themselves purchase; and similar inequities obtain on all sides.

SAVING FUEL BY SAVING POWER

Federal Administrator Points Out that Electric Railways Could Use Central Station Energy

Fuel saving through conservation of electric power used by electric railway companies is sought in a communication which the United States Fuel Administration has sent to the various state fuel administrators. State administrators are urged to secure the co-operation of electric public utility concerns to eliminate all wasteful use of electricity. The communication reads in part:

The conservation department of the Fuel Administration is, as you are aware, investigating every possible opportunity to save coal, which, of course, includes the saving of electricity.

An investigation convinces us that electric railways offer a chance for large savings, particularly through reductions in schedules. We are not suggesting changes in railway schedules which will seriously inconvenience the public, but it is well known that the pressure of private interests has in many instances led the electric railways to provide service which represents a wastage. In addition, our attention has been called to a number of other opportunities for economy of electric railway companies. One has to do with heating of cars. It has been stated that heating represents nearly 30 per cent of the electricity used. May it not be possible to make a substantial saving?

In many cases the system of power stations could be revised with large fuel savings, as is done in Great Britain. There are, along lines of railways in thickly populated districts, power stations with more or less obsolete or inefficient equipment which could, we judge, be discontinued or reserved as relay stations through arrangements for railway companies to obtain power from other more efficient stations of other public utilities.

If public utilities which produce power at lowest cost could furnish the regular requirement of railways and the railway plants be merely maintained as relays, the saving in electrical power, and therefore in coal, would be considerable.

All companies should be urged to renewed vigilance in scientific economy in firing power plants and cutting off every kind of leakage and wastage, especially in transmission systems. We shall be glad to hear that you have found it possible to effect considerable savings.

ELECTRIC SIGN RULES STRICT IN MICHIGAN

Acute Coal Conditions Lead State Fuel Administrator to Limit Burning Hours of Signs More Closely

Fuel Administrator Prudden of Michigan, with the authority of the Federal Fuel Administrator, has issued electric sign operation rules to apply in Michigan while the acute coal situation exists. This indicates that the national order is only a minimum restriction and that each state, if conditions seem to demand, can issue stricter regulations.

The Michigan order eliminates entirely the burning of all roof signs, outline lighting and marquis lighting. In other respects it conforms with the national order. However, owing to the fact that Detroit has Eastern time, the merchant with a directional sign may burn his sign only twenty minutes, since he may turn it on at 5.10 p. m. and off at 5.30 p. m. if he closes his store at that hour, as many do.

There is some talk of a similar order in Ohio.

Throughout the Middle West the sign order appears to be meeting with only such degree of obedience as is insisted upon by local central station companies. In the larger cities the companies seem to be enforcing it rigidly by employing patrolmen to see that owners comply.

An opportunity to observe the effect of the national order was afforded in Chicago on Nov. 28, when there was practically no daylight owing to a murky cloud of fog and smoke from morning until night. Ordinarily under these conditions signs are operated all day. On this occasion it was noticeable that only a few of the smaller signs, principally those connected on the same circuit with window lighting, were on.

ELECTRIC SIGN RULING BY FUEL ADMINISTRATION

Federal Administration Issues Letter to State Administrators Noting Reports that Order Is Not Being Closely Obeyed

The United States Fuel Administration issued the following electric sign ruling to state fuel administrators on Dec. 3:

We wish to call your attention to the electric sign order of Nov. 9 [This refers to the original order, published in full in the Electrical World of Nov. 17, 1917, page 969.—Eds.] and request that you carefully note the following synopsis of the main points of the order:

First—The order provides that diectional signs on retail stores may be illuminated from one-half hour after sunset until the regular closing time for transacting business, but not later than 11 p. m. Directional signs are signs over the door or extended over the sidewalk which give the name and the nature of the business. Exterior advertising signs other than those of a directional character shall not be illuminated earlier than 7.45 and shall be extinguished at 11 p. m.

Second—Directional signs on theaters are the name of the theater and the name of the performance. Such signs may be illuminated from one-half hour after sunset until one-half hour after the time scheduled for the commencement of the performance. The display or advertising signs on theaters and places of assembly, however, may only operate from 7.45 to 11 p. m.

Third—In the case of moving-picture theaters with a continuous performance directional signs may be illuminated from one-half hour after sunset until one-half hour after the beginning of the last performance. Display advertising on such theaters may only operate between 7.45 and 11 p. m.

Fourth—Directional signs on hotels may be operated from one-half hour after sunset until 11 p. m., but display advertising on hotels, either on the roof or on the front of the building, may only be illuminated from 7.45 to 11 p. m. This does not prohibit the use of porch or entrance lights on hotels as excepted in paragraph (d).

There will without doubt come to your attention some cases where you will have to determine whether or not the sign is within the spirit of the order. The authority is given you in the latter portion of paragraph (c), which states that the size of the signs and the amount of electricity used to operate them shall be reduced at any time upon the direction of the State Fuel Administrator.

State fuel adminitrators should define the rulings carefully and make public announcement thereof.

We regret to note that reports are reaching us from some cities that the order is not being closely obeyed. It may be necessary, if the State fuel administrators cannot enforce the spirit of the order, to withdraw all exceptions and forbid the illuminating of all electric signs from 7.45 to 11 p. m. We earnestly request your hearty co-operation in enforcing compliance with our rulings.

PENDING CHANGES AT THE NATIONAL CAPITOL

One, Possibly Two, Members Will Withdraw from Federal Trade Commission—Chairmanship of Important House Committee

Interesting changes in regard to positions at Washington are expected and others are under consideration coincident with the opening of Congress this week.

William J. Harris, chairman Federal Trade Commission, announces that he will leave that body and endeavor to obtain the seat of Senator Thomas W. Hardwick of Georgia. There is a rumor that Joseph E. Davies, former chairman, now a member of the commission, will go to the Senate in place of the late Senator Husting of Wisconsin.

Representative Adamson of Georgia, chairman of the powerful and important committee of the House on interstate and foreign commerce, which will have much to say as to water-power legislation and railroad affairs, will retain his seat for the present. He was confirmed as appraiser of merchandise at New York by the last Congress, but there is a deadlock in his home district over the nomination of a successor, and as many important matters are to be before his committee at this session he has decided not to qualify for his new position until the Georgia political fight is settled.

Representative Thetus W. Sims of Tennessee is the ranking Democratic member of the House committee on interstate and foreign commerce and will succeed Representative Adamson.

Mechanical Service in the Signal Corps

Skilled mechanics are in great need back of the lines to keep the United States aviation service in effective and vigorous action.

The government must have plenty of skilled workers at once in the aviation section of the Signal Corps. Young men called in the draft may volunteer before Dec. 15 in such branches of the service as will enable them to serve their country with the greatest effectiveness according to their technical and mechanical skill.

Public Service of the Engineer

American Society of Mechanical Engineers, at Annual Meeting in New York This Week, Discusses Service of the Engineer to the Public in War and Peace Crises—Fuel Economy

WAR topics predominated at the annual meeting of the American Society of Mechanical Engineers, held in New York, beginning on Tuesday of this week and lasting until Friday. Dr. Ira N. Hollis, president of the society, spoke on "Universal Public Service in Peace and War"; Gano Dunn on "The Engineering Societies in National Defense"; Dr. Charles S. Howe on "Special Education in Time of War"; Prof. L. P. Breckenridge on "The Fuel Problem," and C. E. Skinner on "Engineering Research."

Many notable speakers, including ex-President Taft and Major-General Goethals, also addressed the meeting on war subjects, the former speaking on the "War's Call to Professional Men." On the evening of the first day's session an honorary membership was conferred upon Major-General Goethals in recognition of his achievements in engineering. These functions were followed by a reception to the new president of the society, Charles T. Main.

The fuel problem, for which all electrical engineers can help to find a solution, was discussed more at length in one of the parallel sessions on the second day of the convention. A full discussion of this subject is presented in this report.

Among other particularly timely subjects discussed were the "Employment of Women in Skilled Industries" and "The Engineer, the Cripple and the New Education." Accounts of these discussions will be presented in a subsequent issue of the ELECTRICAL WORLD, with features of the public hearing by the power test committee.

PRESIDENTIAL ADDRESS OF DR. HOLLIS

Dr. Ira N. Hollis, in his presidential address on the "Service of the Engineer to the Public in Times of Crises," said that our relation to the government may roughly be divided under four heads:

1. The civil routine, or conduct of business in government.
2. Civil research and publicity for the benefit of citizens.
3. Military training in peace.
4. Military training in war.

"The twentieth century is still young," said Dr. Hollis, "and we do not yet know what it will represent to the future historian. Will it be the debauch of science, or will it mean a new birth to Christianity? It is the engineers' task to decide this. There are two tendencies—one toward greater comfort and luxury, and one toward greater service. The first can plunge us only deeper and deeper into war for the control of a commercial output. It can only bring us more firmly under a governing class derived either by birth or by commercial success. The second means the complete emancipation of the individual trained to think of service as the chief source of good government and happiness in life. The only theory that will hold men together is that of service."

In opening his paper under the title "Engineering Societies in the National Defense League," Gano Dunn took the occasion to direct the attention of the convention to the heroic deeds of American engineers on the battlefields of France during the past week. He pointed out that the engineers are now "coming into glory and honor."

The whole government of the United States, so far as the army and navy are concerned, Mr. Dunn said, rests on a foundation of engineers. In considering the relation of the engineer to the national defense the speaker started with the Naval Consulting Board. To this board were appointed two representatives from each of eleven different engineering bodies by the Secretary of the Navy on nomination of the respective societies. Ever since the beginning this body has been giving valuable service in many ways, some of which are: (1) The inventory of industrial resources; (2) experiments on and development of important devices, in which it is now helping both the army and the navy; (3) as a board on inventions. This board is examining thousands and thousands of suggested devices.

Next comes the National Research Council, started before the war as an outgrowth of the National Academy of Science formed during the Civil War. The keynote is science. Engineering has its place in this body only in its connection with scientific research.

The general engineering committee of the Council of National Defense is the next in order. The development of this committee was traced as follows: Engineering societies offered the services of their engineers to the President of the United States, which offers were turned over to the Council of National Defense. This body, in turn, placed them in the hands of a member on engineering, who went back to the societies, asking them to nominate members who could be appointed to the general committee. The national engineering societies have served as a center where the government could go for an adequate roster of all who could be called into engineering service.

Considerable confusion has arisen owing to the great number of committees, some thirty-two in all, representing engineering broadly, and with the realization of this situation representatives from each of these committees have met. At this meeting there was appointed a sub-committee to confer with the Engineering Council and the different societies and to report on a plan to prevent confusion of work. This is believed to be sound and fundamental, particularly when not so long ago it looked as though engineers, who clamored for public work, were least fitted.

Mr. Dunn was of the belief that the more committees there are that represent real service the better for all concerned. What he believed to be necessary are (1) a little more directive force and (2) a little more efficiency and co-operation with other committees before taking up any new work.

It was brought out that the general engineering committee of the Council of National Defense is on the point

of being asked by its chairman to resign because he believes its services to be incompatible with the ruling of the Attorney General on the basis of having business relations with the government. Mr. Dunn believes that if this were carried out to the limit the country would be robbed of engineering services.

In conclusion, Mr. Dunn pointed out that so far as he knew there is no case where the government has called upon an engineer for service where that man has not responded.

Engineering Research

C. E. Skinner of the Westinghouse Electric & Manufacturing Company, in his paper on engineering research, emphasized the unlimited fields that are open to research and the necessity of taking advantage of these fields, not only for work in connection with the war but also for providing for the period of reconstruction that is to follow. He also spoke of the need of men and resources in the field of research.

The morning session closed with a paper on the agricultural problems by Dr. Liberty H. Bailey of Cornell University. Dr. W. H. Jordan was scheduled to speak on this subject, but was called away on war matters.

Charles S. Howe, president Case School of Applied Science, in his paper entitled "Special Education in Time of War," laid emphasis on the need for engineers that would arise after the war, pointing out to what extent engineering colleges had been affected by the call to arms. Students are enlisting all the time and thereby greatly decreasing the number of engineers who would have been available in the future. Dr. Howe also pointed out the extremely urgent demand to-day for trained engineers and the inability of the universities to fill this demand. At present, he stated, the universities are able to supply only about one-quarter of the demand. Efforts have been made by engineering institutions, he said, to obtain the government's consent to keep young engineering students out of the war until they have been adequately trained, but all suggestions of this nature so far made to the government have either been refused acceptance or are still under consideration.

He further brought out the question of the draft, pointing out that before Dec. 15 the young men of more than twenty-one in the universities either must have secured positions in the military forces or else be subject immediately to the draft. This, of course, would take practically all of the two upper classes except those physically unfit, while those in lower classes would undoubtedly be taken as soon as they were of age. He asked whether or not some change therefore should be made in the curriculum on the understanding that owing to army regulations an engineering course, generally speaking, could now be for only two years. The different ways in which universities are helping the government by giving special training, such as military drill, military engineering, practical work in mechanical and electrical engineering and in the chemistry of explosives, were outlined.

Specially Trained Men in the Draft

The following telegram from Dr. Hollis Godfrey, member of the advisory commission of the Council of National Defense, addressed to Dr. Ira N. Hollis, was read:

> Have just been authorized by the Secretary of War to request you to inform all your technical students that if they wait until drafted they can upon summons to the draft camp take with them letter from you stating their special qualifications, such letter to be filed with occupational census questionnaire of War Department under authority of this authorized telegram. Secretary of War also authorizes me to say that every effort will be made to use each student's special training in connection with specialized occupation in the army so as to afford technical students of draft age fully as great an opportunity through the draft as if they enlisted now.

Preventable Waste of Coal

Of the papers presented at the three simultaneous sessions on Wednesday afternoon, one by David Moffat Myers on "Preventable Waste of Coal in the United States" should be of utmost interest to electrical engineers as it suggests a propaganda to conserve 1,000,000 50-ton carloads of coal per year in addition to releasing the cars required in transporting this fuel for other purposes. The author said in part:

> While organized effort is being made to bring about efficiency in the production and distribution of coal, no parallel measures have been adopted to bring about a normal and practicable efficiency in its use. For well-known reasons the boiler plant offers the most lucrative field for producing economies, and these with a minimum of alteration in physical equipment. Hundreds of plants are consuming fuel wastefully, many at no greater than 58 per cent efficiency, whereas it would be comparatively simple to secure 70 per cent efficiency. In short, less than 75 per cent of this improvement would save about 1,000,000 50-ton carloads of coal a year, taking into consideration only those plants using coal for steam-producing purposes, which represent 67 per cent of the coal consumers. This saving is quite possible as few factory power plants exist where an improvement of 10 to 12 per cent in economy could not be made by establishing proper operating methods.
>
> In general there are two plans for the conservation of coal which are at least worthy of consideration. One might be termed autocratic and involves the use of authority to compel coal users to execute such measures of economy as proper authorities might prescribe, limits to be set as to expense to users. Alterations should be directed chiefly to purely operating improvements.
>
> The other plan would be largely an educational one, in which patriotism and efficiency would furnish the motive forces required. The teaching must be accomplished with the utmost simplicity and directness. Above all, it must be in such form as to be readily comprehended and applied. The requisite information must reach the owners and managers of industries, and there must be simple instruction sheets for the engineers and firemen. The vital importance of daily accurate records of coal and water must be taught and information given regarding practical appliances for automatic measurements of both.
>
> Blank forms might be sent in advance to plant owners in order to be advised by them, first, whether they would be willing to co-operate with a governmental organization offering to assist them in reducing their coal consumption, and second, to obtain such data as to size, type, equipment, operation and fuel consumption of the plants as would enable a classification which would permit a government board of experts to send such instructions as would include the information needed for any one class of plants. This work would be very greatly aided by a staff of experts ready to visit plants when so requested by owners, and make investigations and recommendations and keep in touch with the progress of economies.
>
> Present examinations of operating engineers for licenses call for practically no knowledge of steam and fuel economies. This is a very serious defect and is directly responsible for a large preventable waste of fuel.

The presentation of this paper aroused considerable valuable discussion. Among those taking part were E. M. Huyck, W. N. Polakov, Prof. L. P. Breckenridge, Norman Reinicker, J. S. Lane, E. N. Trump, E. A. Uehling, W. B. Jackson and Albert A. Cary.

Mr. Polakov, who in his remarks dealt especially with priority in fuel deliveries for efficient users of coal, said in part:

There are already many plants that have reduced their coal consumption from 20 to 40 per cent for the same output, by better organization of power plant work. Van H. Manning, director of the Bureau of Mines, recently said: "We cannot scrap all out-of-date power plants. We must start by doing the best with what we have. We must reach the man with the shovel." The strength of England, France, and also of the Central Powers, is due to the co-operation of industries. Those who fail to render service to the common cause are denied the privilege to mismanage their plants. Voluntary co-operation for which we long will come after the war as the result of new social readjustment, but we cannot wait. To-morrow may be too late. In other words, we must create conditions stimulating voluntary co-operation even under individualistic régime.

The solution, therefore, is the abolition of privilege to waste fuel in inefficiently conducted plants by giving priority in coal deliveries to those who prove that they do use fuel efficiently. Such encouragement of efficient plants rendering good service to the country and stimulating the inefficient to seek salvation through the means beneficial to the country can be accomplished along the following lines:

1. Rating by experts (nominated by the national engineering societies and supported by public opinion and government) of plants in the indispensable industries that are entitled, because of coal-saving methods in use, to the priority in coal supply.

2. Receiving of applications by the special service bureau of the American Society of Mechanical Engineers from the low-rated plants for assigning the expert help.

3. Serving the needs of such inefficient plants by offering services of recognized experts in power plant management for direction of the work.

4. Organizing a staff of steam, electrical and combustion engineers, whose members will be assigned to carry out the work in the plants of the applicants under the direction and supervision of experts.

5. Charging for such services an adequate compensation to cover the expenses involved (salaries, traveling and office) but no profit.

Mr. Myers' second plan, "an educational one, in which patriotism and efficiency would furnish the motive forces required," is in my opinion doomed to failure for the following reasons:

1. Teaching efficiency by a correspondence school method will accomplish little good, is incompatible with the professional dignity of this society and lacks the personal touch.

2. Endless variety of equipment, grades of fuel available, personality of men, nature of load, climatic conditions, etc., make the preparation of "simple instruction sheets for engineers and firemen" impossible, and if same are made they are so general as to be useless.

3. No instructions of real value could be given unless examination of the plant was made.

4. Keeping records, logs, etc., necessitates instrument equipment and measuring devices. All of this is good only when the data are used and interpreted by a trained man and this is done continually.

5. If the regular employees failed to secure high efficiency, it is not because of the lack of "circularized education," but chiefly on account of: (1) lack of time to carry on investigations and tests, all the time being absorbed by routine duties; (2) absence of instruments, facilities or encouragement; (3) lack of experience in this highly specialized line of research work.

6. The education should begin with owners and managers, not with the firemen.

7. Educational talks and circulars usually degenerate rapidly into debating societies, wasting time needed for deeds.

Summarizing, the problem is to be solved by groups and individuals available through the A. S. M. E., by the services of those who know how more power can be got out of a pound of coal. There is no necessity to compel plant owners to improve their methods since in such a step lies their self-preservation. But there is an urgent necessity from the national standpoint to conserve the fuel by preventing its waste by ignorance or indifference. The valuation of plant methods to establish ratings for priority in coal deliveries is therefore recommended.

Mr. Cary also recommended that engineers be required to pass an examination which would show their fitness to burn fuel economically, suggesting that it be conducted under the supervision of the War Coal Board, but also called attention to the fact that a large percentage of fuel could be saved by redesigning the furnaces for the particular fuel used.

Mr. Huyck pointed out that many industrial plants under the pressure of increased production are not giving proper attention to economical fuel utilization, and hence should be compelled to do so. In the period of depression which is likely to follow the war there will be still further need of increasing economy.

PRESSURE ON STEAM PRODUCERS MORE IMPORTANT THAN ON DOMESTIC CONSUMERS

Since 67 per cent of the total fuel mined each year is consumed by 250,000 steam-producing plants, whereas only 15 per cent is consumed by 20,000,000 domestic users, Professor Breckenridge urged centering conservation efforts on the former. This can be done by engineers in each state co-operating with the local representatives of the Fuel Administration. In New Haven, Conn., the Chamber of Commerce called together foremen, owners and operators of all plants in that city and opened the meeting with lectures on coal conservation. As a result of calling attention to the possibility of plants being shut down owing to coal shortage, an experience meeting ensued in which all took part. The meeting ended with the invitation to all plant owners to communicate with the fuel conservation committee if they wanted their operating conditions analyzed and economy measures suggested. Similar meetings were urged in other cities. Instructions cannot be given by correspondence. Results can only be obtained by visiting plants.

Mr. Reinicker urged the scrapping of old, inefficient equipment where deliveries can be secured on new apparatus.

Messrs. Lane and Uehling emphasized the need of instruments to tell firemen when they are securing the best economy.

Mr. Trump urged the adoption of bonus systems, as the firemen will then see some direct advantage in co-operating.

In closing the discussion, Mr. Myers called attention to the fact that the efficiency of any apparatus is equal to the product of the efficiency of the equipment and the efficiency of operation, so operation is just as important as the design. It is not a question of cost. Transportation is curtailed, the coal supply is disappearing, and plant production is reduced; therefore money has to be spent to conserve fuel. The owners and managers of plants must be made to understand that if they do not improve economy the government will curtail or even stop the supply of coal.

The things that can be done first to increase economy are the things that should be considered. Improvements of operating methods should not be delayed just because equipment is inefficient. This can be changed later.

Other papers of intense engineering interest were presented. Among these were: "A Commercial Analy-

sis of the Small Turbine Station," by W. J. R. London; "The Cooling of Water for Power Plant Purposes," by C. C. Thomas, and "The Transfer of Heat Between a Flowing Gas and a Containing Flue," by Lawford H. Fry. Abstracts of these and the discussions they aroused will be presented later.

WAR CONDITIONS AND THE BALTIMORE COMPANY

President Wagner Writes Confidently of the Position of Public Service Utilities, Particularly Those Supplying Electric Power

President Herbert A. Wagner of the Consolidated Gas, Electric Light & Power Company of Baltimore, in a reassuring statement to shareholders, says in part:

So far as public service companies are concerned, and particularly those supplying electric power, changing conditions have been so far very much to their advantage. This is particularly true in the Consolidated Gas, Electric Light & Power Company, where enormously greater amounts of electric power are required for new industries and large extensions to old industries which have been hastened by the great stimulus given by government contracts, not only for munitions and shipbuilding, but for staple products in unusually large quantities. As a result this company is more stably prosperous than ever before. There is no cloud on the horizon, and none is expected, which would by any probability impair the ability to continue paying dividends at 8 per cent. This rate was established in March, 1917, when it was recognized that war was imminent, and after full consideration of possible changes in business conditions. Nothing unprovided for at that time has come to pass or is indicated in the present situation.

While cost of supplies and labor is increasing, it is equally expected that constant efforts of the management to bring about increased revenue and greater economy in operation will fully compensate for such increased costs. A stabilizing factor of paramount importance should never be overlooked —the twofold advantage in its contract for a term of years for a controlling amount of hydroelectric power from the Pennsylvania Water & Power Company, and a contract also for a term of years with the Bethlehem Steel Company for a controlling amount of coke oven gas at a reasonable price from its Sparrows Point plant.

At present, output of electricity and gas and revenue is being increased by greater amounts than at any time in the company's history, and contracts entered into for sale of power assure continued large increase next year. The company has secured ample capital and made favorable contracts for apparatus, to take care of all expected increases in business for the next two years.

The company has further protection to earnings in the event of increases in cost of fuel used in production of electricity by introducing into its power contracts an automatic adjustment of the rate, depending upon the price for coal.

In past years the management has satisfactorily overcome all obstacles which might interfere with constant improvement and betterment in condition and earnings, in spite of periods of general business depression, rate decreases and increasing costs of material and labor. There has never been a year since the present company was in existence that did not show very substantial increase in earnings over every previous year. At no time has the company's financial condition taken a backward step or even stood still. This applies to the period from the year ended June 30, 1907, when the company was earning 2.11 per cent on its common stock, to the year ended June 30, 1917, when it was earning 15.16 per cent. When the management gives assurance that this advance will be continued without interruption it speaks from actual experience during its unbroken record and its demonstrated ability to forecast and prepare for future conditions likely to affect business.

This company has been assured by the United States Fuel Administrator that we need have no fear of insufficiency in supply of coal, and that this company's needs have been taken care of. This is particularly for the reason that munition factories and almost all government contractors in Baltimore and vicinity are dependent upon electrical power from the company for their operations. This company is particularly fortunate in being served directly by the principal coal roads upon which bituminous coal mines are located within comparatively short distance from Baltimore.

Earnings for the last four months ending Oct. 31, 1917, as compared with like months for three years prior thereto, are shown in the following table:

July 1 to Oct. 31	Net Earnings	Increase	Per Cent Inc. Over Same Months, Prior Year
1917	$1,340,975	$160,231	13.57
1916	1,180,744	98,036	9.05
1915	1,082,708	52,277	5.07
1914	1,030,431		

CONFERENCE ON THE EXCESS PROFITS TAX

Meeting of Representatives of Some of the Leading N. E. L. A. Companies to Act on Invitation of Commissioner Roper

President John W. Lieb of the National Electric Light Association called a conference on Nov. 26 of counsel of some of the leading member-companies and some of their accounting and taxation experts to consider an invitation that had been received from Daniel C. Roper, Commissioner of Internal Revenue, to submit to the Excess Profits Advisory Board the suggestions of the industry as to the most practical method of computing the "invested capital" provisions of the excess profits tax law. At this conference there were present E. W. Burdett, representing the Edison Electric Illuminating Company, Boston; H. J. Hemmens and H. M. Edwards, representing the New York Edison Company; O. D. Young and J. F. Zoller, representing the General Electric Company; W. G. Beale, representing the Commonwealth Edison Company, Chicago; D. T. Flynn, representing H. M. Byllesby & Company; E. K. Hall, representing the Electric Bond & Share Company; P. H. Gadsden, representing the Charleston (S. C.) Consolidated Railway & Lighting Company; H. H. Crowell, representing Hodenpyl, Hardy & Co., and H. A. Moore of Cravath & Henderson, representing the Westinghouse Electric & Manufacturing Company.

The conference decided to ask the advisory board for a hearing, which was granted. Messrs. Crowell and Gadsden were selected by the conference to present certain suggestions to the advisory board at a hearing on Nov. 28.

Governor Whitman at Schenectady

Gov. Charles S. Whitman of New York, accompanied by nearly 100 State officials, visited the General Electric Company plant in Schenectady on Dec. 5 as guest of the company. From the band stand in Factory Street Governor Whitman addressed the employees during the noon hour in a stirring patriotic speech. After a buffet luncheon with company officials, Governor Whitman and the members of his official family made a tour of inspection through the plant, which is the largest manufacturing establishment in the State, covering as it does 328 acres of land, with 5,500,000 sq. ft. (467,000 sq. m.) of floor space, and employing 25,000 men and women.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Duty of Utility to Persons Engaged in Moving a House.—It has been held by the Missouri higher court in Logan versus Empire District Electric Company (L. R. A., 1917, E. 258) to be the duty of an electric company to anticipate the moving of buildings of greater height than the wires maintained by it and to take precautions to protect persons liable to be on such structures from danger of coming in contact with its wires.

Riparian Owners' Rights.—The plaintiff purchased from defendant riparian proprietors the waters that flowed in a creek and which they had appropriated and also stored other waters in a lake from which the creek was fed. The Supreme Court of Washington held, in Pleasant Valley Irrigation & Power Company versus Barker (167 P. 1092), that the defendants were not thereafter entitled to any waters in the creek. Under the code provision declaring that any person may take any water which he may have the right to use along any natural stream or lake of the State, but not so as to cause the water to rise above high-water mark, plaintiff, which owned the waters in a lake, was authorized to use a natural stream flowing from the lake in lieu of an aqueduct, and defendants, though owning the bed of the stream, which was non-navigable, and the banks thereof, cannot complain where the level of the stream was not raised beyond high-water mark and their property was not eroded.

Injuries to Employee Dumping Ashes.—The plaintiff was employed in a power house to take ashes from under boilers, wheel them to a pit partly filled with water and tip them into the pit. The ashes were sometimes hot or red hot, and plaintiff was injured as he tipped the ashes into the pit on one occasion by steam and heat flashing up and burning his eye. There was evidence that the hot ashes flashed up in the same way at other times. The Supreme Judicial Court of Massachusetts (117 N. E. 336) held that the facts did not show negligence, there being no suggestion that this method of disposing of the ashes was not proper and usual. Where the same method of disposing of the ashes had been followed during the entire period of plaintiff's employment and he was fully aware of all the ordinary incidents of the work, including the fact that there is liable to be a splash when a body is thrown into water, no warning was required. Where there was evidence that water from a pipe under the boilers trickled out to wet and dampen the ashes, and that they became cool if they stayed long enough, and that on the occasion of the accident the water had stopped coming down, the testimony did not warrant a finding that this stoppage of the water constituted negligence on the part of the employer having a causal connection with the injury sustained by the plaintiff.

Admissible Evidence in Case of Shock.—In an action for the death of an employee based upon faulty insulation of a cord attached to an electric light, expert testimony as to the different ways in which a ground could be produced and that unless there was a ground a person could not get a harmful shock was admissible as bearing on the degree of caution required of the employer, the Supreme Court of Vermont held (102 A. 53). Evidence of the precautions taken by the employer to prevent grounds was admissible; expert testimony that moving the lamp from place to place would cause the insulation just above the socket to break away was admissible; testimony that deceased knew nothing about electricity was inadmissible; testimony that deceased talked about the dangers of his employment but made no mention of the dangers of electricity was admissible. It was the duty of the employer to exercise constant and active vigilance of a searching character to keep safe the electric light used by the foundry employee. In an action for the death of an employee it was held under the evidence that the lack of insulation of the electric light cord was a proximate cause, if not the only cause, of the accident.

Liability for Injury from Dam Maintenance.—The property rights relative to the passage of waters that naturally percolate through the land of one owner to and through the land of another owner are correlative, and each landowner is restricted to a reasonable use of his property as it affects subsurface waters passing to and from the land of another, the Supreme Court of Florida held in Cason versus Florida Power Company (76 S. 535). Where a riparian owner by erecting and maintaining a dam across a stream raises the level of the stream so that the flow of percolating waters from the adjoining lands of another owner is obstructed, and because of the dam the waters from the stream percolate through the land of the riparian owner into such adjoining land, causing its subsurface waters to rise and remain so near the surface as to injure the land and the improvements and crops thereon, such use by the riparian owner of the land and waters may be unreasonable with reference to the rights of the adjoining landowner, and the party erecting and maintaining the dam may be liable in damages for such injuries to the adjoining property as are proximately caused by the dam, and the questions of unreasonable use and resulting damages should be submitted to the jury upon appropriate instructions, when there is any substantial evidence to sustain the contention that such use and damages are in question.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Present Conditions Not Merely Temporary.—In allowing the Milford & Uxbridge Street Railway Company to make increases in fares the Massachusetts Public Service Commission says: "There seems no reason to believe that if the full increase desired were allowed the company would be able under present conditions to earn an exorbitant and unreasonable return upon its investment. Nor can it be said that present conditions are merely temporary. Whatever may be the merits of the claim that a street railway company in these times ought not to ask a normal return upon its investment, it certainly is not the principle upon which the industries are acting which are supplying coal, steel and other materials to the railways; nor is it a principle upon which this commission would be justified in proceeding under law."

Rates, Value and Depreciation.—The Superior Court of Pennsylvania has rendered an opinion reversing an order of the Pennsylvania Public Service Commission affecting rates and valuation in the case of the Ben Avon Borough et al. versus Ohio Valley Water Company. It says in part: "The business of rate making should not be an effort to impose on either the public or the corporation, and, while it may be true that some corporations in the past have acted unfairly to the public, that would not justify a confiscatory valuation by the commission or a lowering of rates causing a confiscation. . . . To induce investment and the continuance of capital, there must be some gain commensurate with that of any other business. The mere assurance that the investment will not be confiscated will not suffice. . . . Depreciation, though largely theoretical in its nature, which is allowed on the reproduction cost seems to have a fixed place in valuation. If, however, replacements and renewals are amply provided for and made, depreciation only to a very small extent takes place. If through depreciation the value of the property is largely reduced, the securities which were placed thereon may be unnecessarily reduced in value. As these charges withdraw from the rate-making base, such depreciation naturally effects a purchase of a part of the property for the consumer, a thing never contemplated. A rate for renewals and replacements should be provided and expended for that purpose; when that is done, as is the custom in every utility concern, depreciation is a very small fractional per cent. This should be placed in a reserve, and it, with renewals and replacements, is properly allowable in fixing a schedule of rates."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

San Francisco Section, A. I. E. E.—At the Nov. 23 meeting of this association M. M. O'Shaughnessy, city engineer of San Francisco, gave an illustrated talk on "Construction of the Hetch Hetchy Project."

Southwestern Illuminating Society.—At a recent meeting of the Southwestern Illuminating Society held in Kansas City, Mo., E. G. Stephens of the Stephens Chandelier Company was elected president and James Mundstock of the Western Chandelier Company was re-elected secretary.

Pennsylvania Contractors Adopt Goodwin Plan.—At a luncheon held in Philadelphia on Nov. 23 the Pennsylvania Association of Electrical Contractors and Dealers adopted the Goodwin plan of electrical merchandising. The speakers were James R. Strong, William C. Goodwin, A. D. Babson and S. A. Chase.

Some Recent Investigations in Arc Welding.—W. O. H. Eschholz of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., presented a paper on "Some Recent Investigations in Arc Welding" before the Philadelphia Section of the Association of Iron and Steel Electrical Engineering on Dec. 1.

Jovian Electric League, Los Angeles.—The Nov. 21 meeting of this league was designated "Ladies' Day." The members and their guests were addressed by Judge Thomas P. White on "The Golden Rule" and by Claire Hosler Coombs, lecturer for the American Red Star, on "Over No Man's Land with the Horses and Dogs."

Chicago Section, A. I. E. E.—Bert H. Peck, electrical engineer, Illinois State Utilities Commission, read a paper on Nov. 26 to the Chicago Section, A. I. E. E., entitled "Engineering Data Necessary for an Electric Rate Determination." About 150 were in attendance, and the paper was discussed by Commissioner Walter A. Shaw, E. J. Fowler, J. G. Wray, R. F. Schuchardt and A. C. King.

Electrical Contractors' Association of Massachusetts.—A special meeting of this association was held at Worcester on Nov. 27 to adopt a new constitution. James R. Strong presented an explanation of the Goodwin plan. The State executive committee held a meeting immediately after the regular meeting and elected the following officers: State chairman, Alfred J. Hixon of Boston; secretary, J. E. Wilson of Boston; treasurer, Frank L. Barnes of Boston; State committeeman, W. K. Tuohey of Springfield.

New York Section, I. E. S.—A joint paper on the "Adaptation of Incandescent Lamps to Motion-Picture Lamps" will be presented by J. T. Caldwell of the National Lamp Works, A. R. Dennington of the Westinghouse Lamp Company, J. A. Orange of the General Electric Company's research laboratory and L. C. Porter of the Edison Lamp Works at a meeting to be held at the Edison film laboratory, New York City, on Dec. 13 at 8 p.m.

Electrical Men Form Business Club.—The electrical men of Philadelphia have formed an organization to be known as the Electric Club of Philadelphia. The following officers were elected at the first meeting: President, Washington Devereaux, chief of the electrical department of the Philadelphia Fire Underwriters' Association; vice-president, Frank H. Stewart of the Frank H. Stewart Electric Company; secretary, R. C. Williams, Jr., of J. F. Buchanan & Company, and treasurer, M. Edwin Arnold of M. E. Arnold & Company.

Institute Meeting in New York, Dec. 14.—The three hundred and thirty-fifth meeting of the American Institute of Electrical Engineers will be held in the Engineering Societies Building, 33 West Thirty-ninth Street, New York, Dec. 14, 1917, at 8:15 p. m. Two papers will be presented at this meeting—"Magnetic Flux Distribution in Annular Steel Laminae," by Dr. A. E. Kennelly and P. E. Alger of the Massachusetts Institute of Technology, and "Phenomena Accompanying Transmission with Some Types of Star Transformer Connections—II," by L. N. Robinson of Leland Stanford, Jr., University. The latter paper is an amplification of Mr. Robinson's former paper presented at the Panama-Pacific convention of the A. I. E. E. (*Transactions*, Vol. 34, 1915.)

Two New Electrical Contractors' Associations Formed.—On Nov. 26 and Nov. 27 respectively the States of Indiana and Wisconsin discarded their old electrical contractors and dealers' associations to form new associations known respectively as the Indiana Association of Electrical Contractors and Dealers and the Wisconsin Association of Electrical Contractors and Dealers. Both of these organizations adopted in its entirety the model form of constitution and by-laws recommended by the National Association of Electrical Contractors and Dealers. For the purposes of interstate organization Indiana will be divided into possibly twelve or thirteen districts and Wisconsin has been divided into six districts. While officers for the State of Indiana have not yet been elected, the districting and further association plans are in the hands of Mr. Harris of Gary, Mr. Sandborn of Indianapolis and Mr. Swanson of Evansville. Mr. Sanborn was elected state director for the association. In Wisconsin the following district chairmen were elected: M. F. Patrick, Racine; J. D. Warden, Sheboygan; R. J. Nickles, Madison; W. R. Johnson; M. F. Metzger, Eau Claire, and William Meter, Oshkosh.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Power Rate Increase in Lexington, Ky.—An increase in power rates to larger customers may be made by the Kentucky Utilities Company, Lexington, Ky., according to a statement by F. W. Bacon, vice-president.

Ohio Commission Denies Rehearing in Cleveland Case.—The Ohio Public Utilities Commission has denied the request of the city of Cleveland for a rehearing on the valuation of the Cleveland Electric Illuminating Company property. The city may appeal to the Supreme Court. The company has filed reasons why a rehearing should be granted. It contends that the valuation is too low.

Washington-Idaho Power & Light Property Sold.—A. Welch of Portland, Ore., has purchased the property of the Washington-Idaho Power & Light Company, owner of the distribution systems in Lewiston, Idaho, and Clarkston, Wash. Associated with Mr. Welch is W. H. Wehring, prominent in Portland banking circles, together with Eastern financiers. The purchase was made from Liggett & Drexel of New York, who acquired the property about fourteen months ago from the Charles Francis Adams estate in the Lewiston-Clarkston Improvement Company. At that time the purchasers formed the Washington-Idaho Power & Light Company, and the power interests have become definitely separated from the land holdings of the improvement company.

Membership Drive for New York Electrical Society.—A well-directed and organized drive that is expected to result in the addition of 500 new members to the New York Electrical Society has been started by the membership committee, whose chairman is Walter Neumuller, New York Edison Company. Already sixty-one members have been obtained, and the number is expected to grow as the campaign gathers momentum. Mr. Neumuller has associated with him W. S. McClure and S. D. Ward, New York Edison Company, and H. A. Currie, W. J. Moore, W. D. Protosky and G. E. Stephens, all connected with New York companies. All society members have been asked to co-operate, and each member is made a member of an auxiliary membership committee. A chart has been prepared showing the number of new members anticipated each week. Alongside are placed the numbers actually gained. By June 1, 1918, the 500 mark is expected to be reached. Another plan is to keep each member informed. This will be accomplished by printing on the society letterhead a cut of a thermometer showing the degrees of advance.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Charles A. Morss, treasurer of the Simplex Wire & Cable Company, Boston, Mass., has been elected governor of the Federal Reserve Bank, Boston.

F. L. Converse, now associated with the Tacony Ordnance Company, Philadelphia, previously was connected, as an electrical engineer, with the Midvale Steel Works, Coatesville, Pa.

A. E. Lockwood, general manager of the Bluefield (W. Va.) Gas & Power Company, has resigned to enter the army, where he has been commissioned first lieutenant in the Signal Corps.

A. J. Jackson, for some time a salesman in the commercial department of the Wilkes-Barre Company, has been promoted to succeed Ray Stretch as commercial manager for that company.

A. E. Merchant, general manager of the Union Gas & Electric Company, Bloomington, Ill., for some years, has been appointed general superintendent of the New Orleans Gas Light Company.

Richard H. Rice, of the General Electric Company's steam turbine engineering department, West Lynn, Mass., was elected president of the National Conference of State Manufacturers' Associations at Indianapolis, Ind., Nov. 22.

Ray Stretch, who for the past year has been acting as commercial manager of the Wilkes-Barre Company, has been appointed general manager of the Union Gas & Electric Company of Bloomington, Ill., succeeding A. E. Merchant.

W. H. Martin has been appointed agent for the Bessemer district of the Birmingham (Ala.) Railway, Light & Power Company. Mr. Martin entered the employ of the company in 1915 as an appliance salesman, later becoming engaged in lighting promotion.

F. J. H. Kracke, Brooklyn, N. Y., Commissioner of Plant and Structure of New York, and Charles B. Hubbell have been appointed Public Service Commissioners of the First District, to act in this capacity in the absence of Col. William Hayward and Major H. W. Hodge, who are now in active service for the government.

J. V. Murdaugh, commercial manager of the Colorado Springs Light, Heat & Power Company, has resigned to accept a position with a firm in Little Rock, Ark., manufacturing carpets and cleaners. Mr. Murdaugh was formerly commercial manager of the Union Gas & Electric Company, Bloomington, Ill., and before that was stationed in Little Rock with the Railway & Electric Company.

P. D. Kline, who designed, constructed and placed in operation the Ogden, Logan & Idaho Railway Company, was its general manager for five years, and who became manager of the La Crosse district of the Wisconsin-Minnesota Light & Power Company on May 1 last, on Nov. 15 was promoted to the position of vice-president and general manager of the same company, with headquarters at Eau Claire, Wis., succeeding A. E. Peirce, who has accepted service as an officer with the general army.

A. S. Witmer, for six years engineer of sales of the Louisville Gas & Electric Company and its predecessor, the Louisville Lighting Company, has been appointed manager of the commercial department of the Louisville company, effective Dec. 15. Mr. Witmer will on that date succeed Robert Montgomery, who reports to Camp Zachary Taylor, at Louisville, for duty as first lieutenant of infantry. Mr. Montgomery will fill the position, which he vacated last August to go to the Officers' Training Camp, until the middle of the month. The appointment of Mr. Witmer is until such time as Mr. Montgomery may return from military service.

J. C. Nichols, who has been commercial manager of the Union Gas & Electric Company of Bloomington, Ill., has severed his connection with that company and accepted the position of general manager of the Bluefield (W. Va.) Gas & Power Company, succeeding A. E. Lockwood, who has been commissioned a first lieutenant in the United States Army Signal Corps. Mr. Nichols entered the employ of the United Gas & Electric Engineering Corporation nine years ago in the office of the Colorado Springs Light, Heat & Power Company. Five years later he was transferred to the Elmira company in the gas sales department, and later made commercial manager in Bloomington.

Charles T. Main of Boston, a consulting engineer who has served in several public offices for the purpose of advancing the idea of good government, has been elected president of the American Society of Mechanical Engineers, Mr. Main was born in Marblehead, Mass., in 1856 and was educated at the Massachusetts Institute of Technology, from which he was graduated in 1876. Three years later, after continuous service in the institute as assistant in the department of mechanical engineering, be became a draftsman at the Manchester Mills, Manchester, N. H., leaving this concern in 1881 to enter the employment of the Lower Pacific Mills, Lawrence, Mass., where for eleven years he acted in the respective capacities of engineer, assistant superintendent and superintendent. Since 1892 he has practiced as a consulting engineer, with offices in Boston, until 1907 being associated with F. W. Dean in the firm of Dean & Main. Mr. Main has designed and supervised the construction of numerous industrial steam-power and water-power plants, among his largest undertakings being the Wood Worsted and Ayer Mills in Lawrence, Mass., and four hydroelectric developments for the Montana Power Company.

Obituary

Clinton White, for fourteen years a member of the Massachusetts Railroad Commission and of its successor board, the Public Service Commission of Massachusetts, died at his home in Melrose, Mass., Nov. 24, at the age of seventy-two. Mr. White was born in Charlestown, Mass. He was well known in utility circles for his profound knowledge of finance. He retired on account of age in 1915 from the Public Service Commission. He was one of the most highly regarded public utility commissioners who have had a share in New England regulative practice.

Charles Henry Wilmerding, ninth president of the National Electric Light Association, died at his home in Flushing, N. Y., on Tuesday of last week. Mr. Wilmerding was born in 1858 in New York City, and received his early education largely in Europe. His collegiate work was done at Yale, from which he was graduated in 1879 as a civil engineer. This profession he followed first in the East and later in Colorado, where he was engaged for some time in mining and railroad work. During 1884 and 1885 he was assistant engineer on the new aqueduct in New York City, and in 1888 he first entered the field of electricity. In the fall of that year he became superintendent of the Chicago Arc Light & Power Company, and later its general manager. When that company consolidated with the Chicago Edison Company, the predecessor of the Commonwealth Edison Company, Mr. Wilmerding was appointed manager of the operating department of the combined companies. Mr. Wilmerding took considerable interest in association work and in 1895 was elected president of the N. E. L. A. at the Cleveland convention. In 1906 he returned from Chicago to New York, by that time having ceased to have any active connection with the central station industry. For some years past he had been in ill health and confined as an invalid to his home at Flushing, Long Island. He is survived by his widow, Mrs. L. F. Wilmerding, two married daughters, and a son, Lieut. C. H. Wilmerding, Jr.

C. H. WILMERDING

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

BROAD POLICIES FOR VACUUM CLEANER MAKERS

Kenney Patent Licensees Are Considering the Question of Co-operative Sales and Advertising Campaigns

When the Electrical World, in its issue of Aug. 5, 1916, related the events leading up to the establishment of the validity of the Kenney patent, governing the manufacture and sale of vacuum cleaners, one case, against the Bissell Carpet Sweeping Company of Grand Rapids, Mich, remained unsettled. The Kenney patent, No. 847,947, was issued to David T. Kenney, March 19, 1907, and therefore it has seven years more to run. The United States District Court for the Southern District of New York, before which the original case was tried, sustained its basic claims controlling the production of the three classes of vacuum cleaners, viz., stationary, portable and the carpet-sweeper type. On a motion for a review of the decision, the United States Circuit Court of Appeals, Second Circuit, unanimously sustained the lower court's findings.

This is final unless a constitutional question should be raised to take it before the Supreme Court of the United States. This up to the present time has not been done, nor is an action of this kind anticipated by the Vacuum Cleaner Company, the owner of the Kenney patent. The litigation with the Bissell company contested the carpet-sweeper type, and the defendant was defeated both in the district court in Michigan and subsequently on appeal to the appellate court in that circuit. This case was argued and adjusted about six months ago. An accounting was ordered, submitted to the court, and affirmed. Therefore a license to manufacture was issued to the Bissell company of the same scope and nature as had been granted other manufacturers who had previously accepted the decree of the courts as a complete adjudication of the patents, twenty-five in all.

Following the adjustment of their legal differences, an association was formed by the licensees, originally twenty-five in number but now reduced to twenty-one by consolidations, to further the interests of the trade, but in no way to control production or fix prices. Each licensee is at liberty to manage and market his own output. A list of the members of the association, formed about a year ago and known as the Vacuum Cleaner Manufacturers' Association, follows:

American Radiator Company, Chicago, Ill.
Apex Electrical Manufacturing Company, Cleveland, Ohio.
Birtman Electric Company, Chicago, Ill.
Cleaner Manufacturing Company, Cleveland, Ohio.
Duntley Company, Chicago, Ill.
Frantz Premier Company, Cleveland, Ohio.
General Electric Company, Schenectady, N. Y.
Hoover Suction Sweeper Company, New Berlin, Ohio.
Hugro Manufacturing Company, Warsaw, Ind.
Invincible Manufacturing Company, Pittsburgh, Pa.
National Sweeper Company, Torrington, Conn.
W. C. Perkins Company, Chicago, Ill.
Regina Company, New York City.
Richmond Radiator Company, New York City.
Spencer Turbine Cleaner Company, Hartford, Conn.
Eureka Vacuum Cleaner Company, Detroit, Mich.
B. F. Sturtevant Company, Hyde Park, Boston, Mass.
United Electric Company, Canton, Ohio.
United Vacuum Appliance Co., Connersville, Ind.
United Vacuum Sweeper Company, Chicago, Ill.
M. S. Wright Company, Worcester, Mass.

Various meetings of the association have been held from time to time, at which broad business policies and a concerted advertising and sales campaign have been discussed. P. H. Seward, vice-president and general manager of the Richmond Radiator Company, who is chairman, said as yet no definite conclusions on these questions had been reached. Meetings have been held every three months, the last Sept. 15, and an effort is being made to hold another Dec. 15.

THE MEASURING DEVICES MARKET BROADENS OUT

Finding Out How to Make Existing Equipment Do Increased Work Instead of Buying More Is a Policy That Creates Demand

The shortage of capital, the uncertainty of deliveries and high prices are responsible for broadening the market for measuring devices of many kinds. For instance, a central station knows some of its transformers are overloaded. Under the conditions the manager dislikes to buy more transformers. He schemes to get along with what he has. But to be sure his scheme will work he must accurately measure the energy passing through the heavily loaded and lightly loaded transformers which he expects to change. So his engineer's requisition for instrument transformers and for recording instruments goes through without question. This is happening daily according to reports both from operating men and manufacturers. The same situation prevails in the boiler room of the power house, in the industrial plant and in every establishment where there is a possibility of shifting existing apparatus to new locations.

SCOPE OF WASHING MACHINE ASSOCIATION NOW ENLARGED

Meeting at Chicago Discusses Trade Problems, Pledges Government Support and Admits Canadian Manufacturers

The members of the American Washing Machine Manufacturers' Association again pledged their loyal support to the government at the meeting in Chicago at the Hotel Sherman on Nov. 21 and 22 by unanimously adopting the following resolution:

"The members of the American Washing Machine Manufacturers' Association, representing fourteen-fifteenths of all the capital employed in this country to manufacture washing machines for household use and whose production is valued at over $10,000,000 per annum, in convention assembled, unanimously reiterate their pledge to the President of the United States and our country of their unswerving loyalty and of their willingness to devote the resources of their industrial plants to the use of our government for war purposes."

Sam T. White of the White Lily Manufacturing Company, Davenport, Iowa; W. L. Rodgers of the Pittsburgh Gage & Supply Company, Pittsburgh, Pa., and Raymond Marsh, secretary, of Chicago were elected members of the Washing Machine Manufacturers' Association war service committee to represent the industry before the War Industries Board. The association is now compiling a list of the equipment in all plants of all members for the purpose of offering the facilities of the washing machine manufacturers' plants to the government for war purposes.

At the request of Canadian manufacturers of washing machines, the constitution and by-laws of the association were amended to permit them to become members. The next meeting will be held in Chicago, at the Hotel Sherman, on Jan. 23 and 24, 1918.

FOREIGN COMPETITION HERE AFTER THE WAR

Possbility That Engineer Soldiers, Besides Bringing Back New Ideas on Foreign Goods, May Have Agencies for Them

When this war is over, according to statements by authorities on the broader phases of manufacturing, foreign competition in the electrical field will be stiffer than any we have ever known. They base their conclusions on two facts. The United States has made foreign alliances. These obligations carry with them not only military but commercial understandings. When peace comes we will not tolerate our allies setting up tariff barriers against us and we will not expect to set them up against our allies. The belief exists that the tariff wall which kept the products of cheap foreign labor out of this country will have completely crumbled. Besides this, our engineer soldiers now abroad are not required to give their entire time to defeating Germany. They visit England, France, Italy and other countries on furloughs. In their leisure moments they visit things that interest them—engineering projects, power plants and the like. There is therefore the possibility that when they get ready to return to the United States some of them will bring along agencies for these foreign goods. Certainly they will bring new ideas regarding the applicability of foreign goods to American problems. Naturally the United States will then cease to be a secluded country. It will become a world nation engaged in world trade.

There is now plenty of time, it is believed, to prepare for what is coming. And it is not expected that industrial America will be found unprepared. Costs are being studied not only in the factories but in the distributing forces. More efficient methods of production and distribution are at hand. In fact, when industry returns to the manufacture of purely peaceful products, there will be available such increased manufacturing facilities that quantity production at correspondingly low prices is expected to result

METAL MARKET SITUATION

Official Interpretation on Resale of Copper by War Industries Board—Tin Still Advancing

A supposed authoritative interpretation of the War Industries Board's order whereby certain jobbers were authorized to sell copper in less than carload lots appears to have been contrary to the rulings and conditions formulated. The main purpose of the board in the measures adopted for the distribution of copper was to prevent the metal from falling into the hands of speculators who would increase the price to the consumer or manufacturer of finished goods. What the board meant is that no sales of copper are authorized in either car lots or less except at 23.50 cents plus not over 5 per cent, or 24.675 cents. Wire base has receded a cent, but none is offering.

Tin continues to advance in price and become less in supply. Being largely used in the manufacture of babbitt metal, of which journals are almost solely made, its wide employment may be readily understood. The other changes are immaterial.

NEW YORK METAL MARKET PRICES

	Nov. 26	Dec. 3
	£ s d	£ s d
Copper:		
London, standard spot	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	28.00 to 30.00*	27.00 to 29.00
Lead, trust price	6.25	6.25
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	19.00	19.00
Spelter, spot	7.87½ to 7.97½	7.70 to 7.80
Tin, Straits	80.00	81.00
Aluminum, 98 to 99 per cent.	34.00 to 36.00	34.00 to 36.00

OLD METALS

Heavy copper and wire	22.50 to 23.00	22.50 to 23.00
Brass, heavy	14.50 to 16.50	14.50 to 16.50
Brass, light	10.50 to 11.50	10.50 to 11.50
Lead, heavy	5.50 to 5.87½	5.75 to 5.87½
Zinc, old scrap	5.00 to 5.50	5.00 to 5.50

*Nominal.

THE WEEK IN TRADE

NO DIMINUTION in sales of electrical appliances, materials and supplies is reported. On the contrary, the volume is increasing, notably on the regular seasonable lines—Christmas outfits, heating and household specialties; but staples are showing very satisfactory totals in the selling end, differing according to sections. The average, however, is excellent. The shortages in certain lines, such as lamps, sockets, dry batteries, porcelain, etc., are unchanged, and prices are firm and steady. The labor situation everywhere is generally less strained.

Collections and credits appear to be adjusting themselves to changed conditions, and a better understanding prevails between jobbers, dealers and consumers, the undue consideration toward the latter heretofore existing being sharply curtailed. Trade acceptances are favorably regarded as the proper means for superseding questionable book accounts.

NEW YORK

Aside from the staple lines, which are selling as well as could be expected with peak prices and undependable deliveries to contend with, business is measuring up to fairly good weekly totals. Every effort is being made to get adequate holiday stocks in the hands of the dealer for what he anticipates will be a record breaker. Christmas outfits, electrical toys and merchandise of this character are going out in good volume, but heating appliances, vacuum cleaners, washing machines, toasters, grills and sewing machines are the strong sellers.

Collections are up to the mark, as might be expected at this time of the year. Credit men are making a strenuous endeavor to close their books in the best possible shape. Credits and accommodations on new business are becoming more and more stringent.

PORCELAIN.—While porcelain goods have been scarce, a still further shortage may be expected, reports from authentic sources state. Not only are additional labor disturbances mentioned as likely to occur in the factory centers, but there is a possibility of fuel shortage, especially in the natural-gas regions. Should this occur a sharp reduction in the output would naturally follow.

ELECTRICAL TOYS.—Earlier in the season a fair, if not an abundant, stock of electrical toys was looked upon as assured. The situation has undergone modification, and it seems probable that dealers and merchants who have delayed placing orders may be disappointed by having a depleted quantity for their holiday trade. Deliveries are erratic except to nearby buyers.

COLLECTIONS AND CREDITS.—With the close of the year special efforts are being made to close up all the accounts possible, and collections therefore are brisk. Credits are held firm, with no disposition to widen their scope for the present.

VACUUM CLEANERS.—The drive for the holidays has set in with prices firm. The pre-Christmas selling campaigns are along good lines from a trade point of view, and, with the scarcity of metals, general activity, poor deliveries and the evident intention of the public to buy freely, with cost not a primary consideration, sales in all makes are expected to be heavy.

DRY BATTERIES.—Not much if any improvement is noted in the supply of dry batteries, and stocks in the hands of the regular trade distributers are not at all to their liking. Prices and deliveries are unchanged.

LAMPS.—The shortage in lamps reported at various times is still mentioned as not bettering. All sizes are affected, the shortage of miniature and automobile and nitrogen lamps being the most acute.

POLE AND LINE MATERIAL, ETC.—Conditions are about the same as have ruled the market for a month past on price and deliveries, but this means they are better than three months back. The same may be said of pole hardware. A manufacturer of a pole specialty to whom was

recently given an order amounting to 10,000 pieces was obliged to cancel it on account of a lack of material, although on other standard goods he was in a position to make shipments in acceptable time. Glass insulators are a trifle easier in supply and deliveries, but the price is still firm. In fact, it is difficult to figure on any of this material when price or shipments are in question.

REFLECTORS.—Announcement is made this week of a 10 per cent advance on all Holophane "Decolites," effective Nov. 1 last. List prices and discounts are unchanged, the advance to be added as a separate item on each invoice. Also effective Nov. 1, advances in list price were made on a number of Ivanhoe metal reflectors.

CHICAGO

Evidence that the trade is more and more organizing itself on a "long-war basis" is beginning to be seen. The policy of no new central station extensions unless customers pay the cost is becoming more general. Certain utilities are planning to reduce their capital requirements. Stocks are also being reduced. It is claimed that this reduction is no greater than is usual at this period for inventory purposes among the jobbers, but among central stations it is a reduction calculated to help reduce capital in stocks of material. Collections are tightening up somewhat. Prices are steady. The week, on the whole, has been a quiet one in the trade.

ICE MACHINERY.—Seven of eleven ice plants in Chicago which as yet have retained steam drive are coming over to central station service this winter. These seven aggregate 3300 hp. and produce about 250,000 tons of ice a year. For these plants equipment has already been ordered. The field for more sales is still broad, however, with four ice plants aggregating in output 350,000 tons of ice a year and with sixteen refrigerating and cold-storage houses still using steam. The total of motor-driven ice plants in Chicago is now thirty-three.

CONDUIT.—The conduit situation is spotty. Some jobbers who buy from smaller mills can make deliveries out of stock. With other jobbers the situation is getting rapidly worse.

RUBBER-COVERED WIRE.—The price of wire still holds steadily at a 34-cent base. There have been a few spells of weakness created by manufacturers who needed a little immediate business.

APPLIANCES.—Business is not so brisk as usual for the season. Toys and novelties are especially dull.

FIXTURES.—For a time building in special lines seemed to be holding its own. Fixture manufacturers report, however, that conditions do not seem to be improving.

SILK SHADES FOR PORTABLES.—Electric shops are well stocked for Christmas trade. One Chicago firm received some export inquiries during the week.

STORAGE BATTERIES.—The decrease in flat-plate vehicle-type storage batteries made by one concern amounts to about 10 per cent. The decreasing price of lead made this possible. Some batteries, especially those in glass jars, are on the increase, so this movement cannot be taken as a general one in the battery field.

ELECTRIC ARC WELDERS.—Railroads, steel mills and other users of heavy steel and iron equipment are large purchasers of electric arc welders. The difficulty of securing deliveries on new apparatus has made it essential for these concerns to repair old equipment wherever possible and to scrap very little that can possibly be saved. The arc welding machines fit in well with this plan of operation. It is said that one railroad expects to purchase 150 of these outfits within the coming year.

WASHING MACHINES.—The Automatic Electric Washer Company of Newton, Iowa, which has been using twenty-five 200-ft. motion-picture films for the last two years among its dealers, has found this sort of popular publicity so well liked that it has taken a 1000-ft. film which it will permit its dealers to use. The film pictures a story called "Thrift," showing the domestic economy of the electric washer. The film will be ready for the dealers about Dec. 15.

BOSTON

The acceleration of war business and an increasing shortage of skilled labor dominate the electrical trade this week in New England. Jobbers are heavily stocked at Boston, but in interior business centers stocks vary as to completeness. Prices show little or no change compared with last week, except that rubber-covered wire and weatherproof wire are softening a little. It is reported that some manufacturing interests have begun to notice a falling off in purely industrial orders not related to war requirements. Contractors find little house wiring to do, but improvements and extensions in mills are still being carried on actively. Better news from the western front and from Italy, now regarded as a part of the former, have increased confidence. Collections are rather slow, but conditions appear fundamentally sound. High wages at the Squantum destroyer plant, at the Watertown Arsenal and Fore River shipyard, yielding wiremen in some cases $10 per day, including overtime guarantee, make the problem of securing adequate labor difficult for the electrical contractor paying from 50 to 70 cents per hour. Much credit is due the smaller electrical contractors in particular for the patriotic spirit in which they are striving to meet present difficulties. It is not unlikely that some of these may be driven out of business by the competitive situation existing in labor matters with respect to government plant employment conditions unless some means can be found of tiding them over the current emergency. Contractors dealing chiefly with large industrial customers are in a better position with regard to collections and payments to jobbing houses, but many readjustments are under way. Central stations are almost swamped with business, and the reduction in output from sign curtailment appears to be cutting very little figure in view of the demands for industrial power. The bituminous coal situation is getting worse, although herculean efforts are being made to avert disaster. An epoch-making recommendation toward bettering electric railway finances was made a few days ago by Chairman Macleod of the Massachusetts Public Service Commission before the special legislative investigating committee on street railways. In sum, this recommendation was that the State should lend money to companies for rehabilitation and war service construction at rates below current prices of money.

LAMPS.—The situation is improving not a little and orders for current requirements are being filled from stock by some jobbing interests.

SMALL MOTORS.—Purely industrial orders show a reduction in some quarters. Shortage of labor and scarcity of materials militate against accumulation of factory stocks. Women are being used in light winding, and much overtime is being consumed on government work. A heavy demand is noted in small motors for tool driving in gun carriage, boiler, naval turbine and other war production.

CONTROLLING DEVICES.—In some cases deliveries as low as three to five weeks are being made, both on industrial and war orders. This condition applies, however, only in plants which anticipated present demands. Prices are holding firm.

WIRE AND CABLE.—Deliveries are lengthening by three to four weeks compared with recent tenders. Government orders are increasing and inquiries are still being received in connection with the destroyer plant at Squantum.

FIXTURES.—These are moving very slowly and the outlook is not attractive at this time for a satisfactory holiday business. Portable lamps, however, are moving faster and no further price advances are looked for.

TELEPHONE, SIGNAL AND RADIO EQUIPMENT.—Manufacturers are nearly swamped with government work in these branches. One factory reports that 60 per cent of its output is for war service. Labor shortage is a disturbing factor, and it is heard in some quarters that further moderate price advances are not unlikely. Deliveries of about 120 days are quoted on small motor-generator sets for signal service.

STORAGE BATTERIES.—Business is rushing and no signs of a price reduction can be seen. According to class of service, lead batteries are being delivered in New England in from one to two months from receipt of order. Deliveries for automobile service are from stock.

ATLANTA

The volume of business is holding up well, and the normal channels of trade are taking up the slack caused by a decrease in pressure from government requirements. Shipments on small motors, lamps, line hardware and miscellaneous supplies show a slight improvement. There is more or less activity in industrial construction, and a number of large plants are contemplated.

The establishment of an aviation training station at Montgomery, Ala., will no doubt call for a large quantity of electrical supplies. A report has been circulated that the government expects to spend an additional $100,000,000 on building operations in the Southeast, but that is not confirmed at this time.

The government will, however, spend a considerable amount on the erection of a nitrate plant at Florence, Ala. It is also reported that a large industrial concern in the Birmingham district has set aside $10,000,000 for improvements. The shipbuilding operations under way at the coastal cities have stimulated a demand for supplies, which for a time were dormant. All of this activity, together with normal requirements, has kept the electrical interests quite busy, and from the present indications it will be some time before any appreciable slackening will be felt.

PLUG CUT-OUTS.—The substitution of slate for porcelain on cut-outs has helped deliveries and allowed the jobbers to fill contracts and secure business that they might not have been able to negotiate had they depended on porcelain goods. A big demand is developing for the slate product, and the deliveries are good.

POLES.—The demand for poles continues steady, with slight price variations, depending on the supply. Deliveries are fair; the only difficulty seems to be in finding sufficient labor to get out the timber in the preliminary stage.

INSULATORS.—Price remains steady on both the glass and porcelain products. An improvement is noted in glass insulator shipments, but porcelain deliveries are very bad, and there is no immediate prospect of any betterment.

LINE HARDWARE.—The price and demand for this line remain steady. Shipments are growing better, however, showing an actual decrease from six to four weeks.

CABLE.—There is very little change to be noted, as the demand is comparatively steady. Prices continue the same and long deliveries are the order. Local stocks are very low.

CONTRACTING.—All concerns are busy, and the future looks good for continued activity. In addition to industrial work and new residence building, a number of old houses and buildings are being renovated and wired, which has tended to exert more or less pressure, especially when wiremen are scarce. While the lack of electrical workers has caused no end of delay on certain jobs most of the companies have adjusted their organizations to fit the draft and meet the situation.

FLEXIBLE CONDUIT.—More activity was noted in this line during the last week. Substantial quantities were offered, however, at prices slightly below the market prevailing for the last month. Southeastern stocks are in pretty fair shape.

SEATTLE

Seattle electrical jobbers in the past week have reported sales to shipyards, lumber mills and industrial plants about the same as last week or during several weeks. Sales of domestic appliances, particularly washing machines, toasters, lamps, percolators and irons, showed a pronounced increase, due undoubtedly to the approaching holidays. The pre-holiday sales in volume are expected to show a further increase during the next two weeks. The recently organized steel shipbuilding concern in Seattle placed an order for approximately $15,000 worth of motors, also orders for wire lamps and other electrical equipment to be used in the erection of the proposed plant. A new wooden-ship yard in Tacoma is reported to be placing orders for considerable electrical equipment. Prices remain steady with no indication of an early increase or decrease. Shortages on lamps, certain kinds of wire conduit and motors still prevail. Cantonment sales are keeping up well, although a decrease is due shortly with the completion of the work.

Collections for the month of November were easy to make. The satisfactory government collections show a marked improvement over the past few months, being much easier. A closer safeguarding of credits is being advocated and practiced in the Northwest. Retailers are urged to adopt up-to-date systems of accounting and in addition to desist from the giving of long time credits to consumers. Jobbers are pointing out that both jobbers and retailers are in a period of great changes that are almost revolutionary in character and are overturning the entire course of the business world. They feel that the old methods of long-time credits and open book accounts must give way to cash transactions and trade acceptances eventually. Ways to cut down the cost of doing business are receiving serious consideration. However, new industrial plants and shipbuilding concerns, with ample financial backing, are being favored with unlimited credit. A noticeable increase in the placing of credits is noted in Seattle particularly, and this placing will increase, according to an authority, until well after the first of the year, to accommodate new plants which are being started and which have stable financial support.

The lumber production for the week was within 15 per cent of normal. All the mills are pushing production to keep government orders moving. The Northwest mills are expected to be asked to figure on a government order for 700,000,000 ft. of lumber for the construction of cantonments in France. All spruce cutting has been taken over by the government, and standing areas of spruce in Washington and Oregon are to be made available at once for government usage.

The strike of telephone employees in Seattle, which began Oct. 31, ended Dec. 2. The company agreed to recognize the newly organized operators' union and to grant a slight increase in wages, the men's raise approximating 12½ per cent. Strikers in Portland, Tacoma, Spokane and other smaller cities are reported back at work.

Heating devices are moving exceptionally well, owing to colder weather and the increasing cost of fuel, together with poor deliveries. Stocks are comparatively well filled and prices remain steady. Portable lamps show an impetus due to the Christmas trade. There are ample stocks, and prices show no increase. One Seattle dealer states that his volume of sales on lamps during the last two weeks has never been equaled. Electrical fixtures show increased sales.

SAN FRANCISCO

No changes are occurring in trade and market conditions. Prices are steady. The demand continues brisk for supplies and materials for industrial construction, and in practically all other lines where stocks are available sales are at least fair. The volume of business in November last in electrical supplies is generally conceded to be about equal to that transacted in November, 1916. A considerable volume of business continues to come in from small country towns which very helpfully supplements the activity in industrial lines. There is an optimistic attitude in the field, and prospects for a continuation of generally good conditions are even brighter than earlier in the fall season. The prospects for electric appliances are less certain than for materials and supplies. Some dealers report more and some less business than last year. There is one unmistakable tendency, however, and that is toward a preference for handling those lines that are necessities rather than luxuries or that are in some way related to war-time needs.

The Railroad Commission of California last week announced that it would undertake an investigation of ways and means for conserving fuel and power. This will include an examination of the electrical systems of the State and will probably lead to the suggestion that certain transmission lines be interconnected. This move, significant of the desire to increase available power, agrees with the activity for some time displayed by practically all local companies in developing all power conveniently available on their systems. The demand for power has grown steadily and rapidly in recent months, and every indication points toward a continuation of the increase.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B.&S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List to + 10%
Coil to 1000 ft	10% to $59.17
	No. 12 Solid
Less than coil	List to + 10%
Coil to 1000 ft	10% to $59.17

Twin-Conductor

	No. 14 Solid
Less than coil	List net to $105.00
Coil to 1000 ft	$70.00 to 10
	No. 12 Solid
Less than coil	List net to $135.00
Coil to 1000 ft	—10% to $130.9

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	List to + 10%
Coil to 1000 ft	List to — 10%
	No. 12 Solid
Less than coil	+ 10%
Coil to 1000 ft	—10%

Twin-Conductor

	No. 14 Solid
Less than coil	List to + 10%
Coil to 1000 ft	List to — 10%
	No. 12 Solid
Less than coil	+ 10%
Coil to 1000 ft	List to — 10%
	No. 12 Solid
Less than coil	+ 10%
Coil to 1000 ft	— 10%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10% to list net
1/5 to std. pkg	15% to 20%
Std. pkg.	28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1/5 to std. pkg	List to 20%
Std. pkg.	30% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31 to .3175	.32 to .3275
Barrel lots	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16	250	$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25–50	35.00
2	25–50	45.00
2 1/2	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.	$75.00	$63.75 to $69.75
3/8-in. d. stp.	75.00 to 82.50	68.25 to 75.50
1/2-in. s. stp.	100.00	85.00 to 93.00
1/2-in. d. stp.	100.00 to 110.50	91.00 to 100.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75.00	$63.75
3/8-in. double strip	78.75	71.25–71.75
1/2-in. single strip	100.00	85.00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32	$0.05 1/2	1	$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25.00-$55.00	$20.50-$24.75	$20.00-$22.00
1/4-in.—	$28.00-$60.00	$22.50-$27.00	$22.00-$24.00

NET PRICE 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$36.67-$55.00	$25.00-$37.50	$22.50-$24.75
1/4-in.—	$40.00-$60.00	$27.00-$30.00	$25.00-$27.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4	$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37
2 1/2	.58 1/2
3	.76 1/2

	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	4% to 6%	7% to 9 %
2500 to 5000 lb.	6% to 9%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	1.3% to 3.7%	4.3% to 6.7%
2500-5000 lb.	3.3% to 5.7%	6.3% to 8.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6.00
Discount	25% to 30%

CHICAGO

List	$5.00 to $6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.00 to $5.75
1/5 to std. pkg.	4.50

Standard package, 500. List, each, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, each, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4⅝ in., frosted:		
100-watt—G 35	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $33.98
Coil to 1000 ft.	25.50 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $36.24
Coil to 1000 ft.	22.50 to 27.18

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$20.00 to $29.00

CHICAGO

Net per 100	$19.25 to $25.75

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, AX, 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25% to 37%	20% to 32%
$10.00 to $50.00 list	42% to 45%	37% to 40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80 to $38.00
1/5 to std. pkg.	14.80 to 19.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80 to $18.00
1/5 to std. pkg.	13.00 to 14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N. C.	Std. Pkg. 4000 —Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$27.50 to $29.00	$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500 5½ N.C.	Std. Pkg. 4000 —Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$11.85 to $15.00	$20.75 to $30.75
1/5 to std. pkg.	9.00 to 11.10	16.30 to 24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List to net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List to net
1/5 to std. pkg.	List to —15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3. P. S. T.	1.80
60-amp. 3. P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List net to + 5%
$10 to $25 list	11%
$25 to $50 net	14% to 15%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16%
$25 to $50 list	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	List to +5%
$10 to $25 list	List to —11%
$25 to $50 list	List to —14%
	Low Grade
Less than $10 list	List to —5%
$10 to $25 list	List to —16%
$25 to $50 list	14% to 15%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to —30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List	List to + 10%
$2.00 to $10.00 list	10% to 20%	5% to 10%
$10.00 to $50.00 list	20% to 30%	15% to 20%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25%	15% to 20%
$2.00 to $10.00 list	25%	15% to 20%
$10.00 to $50.00 list	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price	$5.00 to $7.50
Discount	25% to 30%

CHICAGO

List price	$5.00 to $6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.44½ to $0.65
No. 18, full spools	0.43¼ to 0.55

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.57½ to $0.65
No. 18, full spools	0.50½ to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11	$15.00-$18.00	$13.00-$14.00	$11.25-$12.00
12	23.25- 27.09	21.30- 23.22	19.35- 20.85
10	32.40- 37.80	29.70- 32.40	27.00- 29.25
8	45.70- 53.34	41.90- 45.73	38.00- 41.38
6	72.40- 84.42	66.35- 72.35	60.30- 65.50

CHICAGO

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	$13.50	$12.00
12	25.21-28.63	21.30-24.54	17.40-22.50
10	34.44-38.25	29.82-32.72	24.25-30.60
8	48.84-54.27	42.18-46.43	34.45-43.20
6	70.80-92.61	61.16-79.23	51.15-74.09

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$35.25 to $40.00
25 to 50 lb.	35.25 to 39.00
50 to 100 lb.	34.25 to 38.00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$40.25 to $42.00
25 to 50 lb	39.35 to 41.00
50 to 100 lb.	38.35 to 40.00

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Strand Connectors

Strand connectors that save the expense of dead-ending messengers on poles are made by the Diamond Expansion Bolt Company of New York City. It is the usual custom in pulling mes-

WILL NOT CHAFE THE CABLE

senger strand to take the dead-end, no matter where it occurs between poles, and wrap the surplus wire around the pole. This connector is placed wherever the dead-end occurs between poles, and the wire is secured at both sides of the connector by means of heavy-pattern three-bolt guy clamps. The whole equipment is compact and sightly and will not interfere with or chafe the lead-covered cable which is supported beneath it.

Electric Fountain

One of the latest electric fountains developed by the Frank Netschert Company, 61 Barclay Street, New York City, uses translucent glass with green or amber shading in the construction of the dome and the brim of the bowl. The center figure is of porcelain. Color changes are effected with a set of tinted electric lamps mounted within the dome. When water is placed in the bowl to a depth of 2 in. (5.08 cm.) the fountain will operate continuously. The 110-volt motor-driven pump throws a spray 22 in. (55.8 cm.) in height.

Compensator Outfit for Projection Lamps

A compensator outfit has been recently developed by the General Electric Company of Schenectady, N. Y., to control the current for the new Mazda projection lamps that have just been put on the market. In order that the projection with these lamps shall attain the highest efficiency and economy a current control must be used with the lamps. This outfit, known as the "Compensarc," type I, has been developed in conjunction with the lamps so that with the Mazda lamps it forms a complete working unit capable of giving the best results.

The outfit is a self-contained device requiring no auxiliary attachments, and is rated at 750 watts, 110/220 volts alternating current primary and 20/30 volts secondary. The working parts consist of a compensator, starting switch, rheostat and ammeter. The starting switch, rheostat handle and ammeter all appear on the face of the cabinet panel where they are handy to the operator. The starting switch at starting up the lamp automatically puts some resistance in the lamp circuit so that excessive rush of current through the cold lamp filament is prevented.

The finer adjustments of electric current through the lamp are controlled at the will of the operator by means of the rheostat handle, the rheostat, having very fine adjustments, being placed in the primary circuit. The ammeter indicates at all times the current passing through the lamp, and the rheostat enables the operator to make any necessary adjustments to compensate for the slight variations in the commercial line voltage.

The field of application of this projection equipment is the medium and smaller motion-picture theaters and the lecture halls in colleges, clubs and military camps where the stereopticon or

REQUIRES NO AUXILIARY APPARATUS

motion-picture machine may be used for educational and instructional purposes.

The simplicity of the operation of the equipment, the low investment and operating costs and the excellence of the projection obtainable are strong factors in its favor, it is claimed.

Electric Bandage Cutter

An electric bandage and gauze cutter which is particularly adapted to Red Cross work is one of the latest developments of H. Maimin, Inc., 251 West Nineteenth Street, New York City. Accidental contact with the motor-driven knife is prevented by the use of a specially designed guard, which is also a knife sharpener. The capacity of the machine, the manufacturer states, is such that it will cut 100 yd. (91.4 m.) of gauze or 50 yd. (45.7 m.) of muslin in three minutes. The machine can also be used for cutting out cloth in large quantities. A pilot or guide lamp is mounted so that its rays are cast in front of the cutting edge, eliminating the shadow which might otherwise be cast.

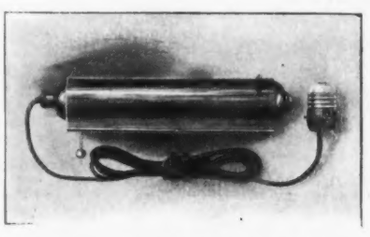
Farm Lighting Set

The Mayhew Company of Milwaukee, Wis., has placed on the market a belted-type farm lighting set which consists of a generator and switchboard made up in one unit and a storage battery, which is shipped separately. The special method used in packing the battery has entirely eliminated the breakage of shipment, it is asserted. The various elements of the plant are of standard makes. The generator is made by the Peerless Electric Company of Akron, Ohio, the batteries by the Globe Electric Company of Milwaukee, Wis. Jewell instruments and Cutler-Hammer rheostat are used on the switchboard, which also includes a Mayhew Electric cut-out of an improved design. Glass inclosed fuses are furnished.

These plants are made in three standard sizes, provided with 60, 90 and 120 amp.-hr. batteries respectively. The generator is rated for 800 watts.

Fixture for Piano Lighting

A piano lamp the hood of which is so constructed that light rays are released only in a downward direction, eliminating objectionable glare, has recently been developed. With this unit, a group about the piano does not have the effect of casting annoying shadows upon the music. Metal construction is used, and the fixture can be supplied in a finish to harmonize with any piano. A pull-chain socket is used, and the outfit is fitted with 9 ft. (2.7 m.) of silk cord and



LIGHT RAYS RELEASED DOWNWARD

a swivel, non-breakable attachment plug. The fixture is manufactured by the Play-O-Lite Company, Buffalo, N. Y., and is being distributed by A. Hall Berry, 717-73 Murray Street, New York City.

Combination Switch and Cut-Out

A type of combination switch and cut-out which embodies features of small size and light weight has been devised by the Connecticut Electric Manufacturing Company of Bridgeport, Conn. The reduction in weight made possible by channeling out the porcelain has been considerable; in fact, the cut-out has been reduced to less than a pound (0.45 kg.) in weight, with a saving of ½ lb. (0.23 kg.) made possible by this new construction. This, it is pointed out, amounts to 500 lb. per thousand, which at the present freight rate to San Francisco, of $3.75 per hundred, is a saving of $18.75 on every 1000 lb. (453.5 kg.) of switches shipped to the Pacific Coast.

Another interesting feature of construction pointed out by the maker is the mounting of the knob on the crossbar of the switch blade so that the pull is at an angle, making the switch convenient and easy to open. These switches are made with either convertible or permanently thin blade, but are furnished permanently thin unless otherwise specified.

Electric Coffee Percolator

A line of electric coffee percolators made in sizes varying in capacity from four to eight cups is being marketed by the Crystal Percolator Company, 44 East Twenty-third Street, New York City. This filter is made in two sections of crystal glass, the lower division being in contact with the electric heating unit in the metal base. The upper portion, or "funnel," holds the pulverized coffee. The manufacturer calls attention to the porcelain strainer through which the coffee passes on its way to the lower container. The coffee does not come in contact with any metal during the process of percolating.

Air Compressor for Office Appliances

The National Regulator Company of Chicago has developed an improved type of motor-operated air compressor made in different sizes for use on commercial circuits. It is especially adapted to the requirements of residences, office appliances, manufacturing plants and doctors' and dentists' offices where the service is not heavy. The compressor is designed for low-speed service, since the special class of work that it does forbids overheating the air. It has also, the manufacturer states, the desirable feature of being practically noiseless in operation.

This type generally is controlled automatically to maintain a constant pressure and is driven by a fractional-horsepower motor made by the General Electric Company. This motor is standard equipment. The apparatus is a unit and has a panel on which are mounted the pressure governor, high-pressure and low-pressure gages and the safety valves. The storage tank has a capacity equal to about 10 gal. (37.9l.) of liquid.

Line-Drop Compensator

The General Electric Company of Schenectady, N. Y., has recently developed a line-drop compensator which when used in connection with any contact-making voltmeter will enable the regulator to provide correct voltage compensation to any given point on the feeder regardless of the load or the power factor. The compensator consists of a resistance and a reactance, each independently adjustable by means of dial switches, whereby the resistance and the reactance of the line may be reproduced in miniature and the effect of the load on the line reproduced in the feeder regulator control, *i.e.*, in the contact-making voltmeter.

The compensator can be furnished either with or without a one-to-one insulating transformer, the latter design permitting the grounding of both current and potential transformer circuits. It can be connected in circuit with any contact-making voltmeter of General Electric manufacture without any change in the meter, regardless of the type or design, and once properly adjusted for the line will cause the regulator to maintain correct voltage within its limits of range and capacity.

FOR USE IN CONNECTION WITH CONTACT-MAKING VOLTMETER

The units of the compensator are assembled in a neat, compact case suitable for mounting on the switchboard if desired. It is easily adjusted and after correct conditions are obtained for a given feeder requires no further attention.

Electric Manifold Plug

A plug for insertion in the intake manifold of gasoline automobile engines which is provided with an electric heating element is being manufactured by the Interstate Electric Company of New Orleans, La. The heating device is controlled from a dash switch and operates on the motor-car battery or on dry cells, as convenience may dictate. The plug also provides a ready means of priming and is piped to a sizable priming cup mounted on the dash. The combination of the two functions furnishes heated vapor to the cylinders, making starting in cold weather an easy matter, as the manufacturer points out.

Bullet-Shaped Flashlight

A new battery flashlight in the form of a cartridge is being manufactured by the Interstate Electric Novelty Company of New York City. The complete lamp measures 6 in. by 1⅝ in. (15.2 cm. by 4.1 cm.). Heavy brass is used in the case. The battery is a "Franco Radio," and supplies energy to a tungsten lamp mounted in the "projectile."

Chain-Pull Candle Socket

A straight chain-pull socket for use in candle fixtures is being made by Pass & Seymour, Solvay, N. Y. Large binding screws are provided and the raceways for wires are conveniently deep. The combination of candle-socket and switch provides a practical economy, the manufacturer points out, in individual control of the lamps. The fitting complete is 3¼ in. (8.2 cm.) long and has a diameter of 1 5/32 in. (2.94 cm.).

Current Limiter

The Railway & Industrial Engineering Company of Pittsburgh, Pa., has recently brought out a protective device for portable electric drills, etc. This device is known as a current limiter. The device opens the circuit instantly on heavy overloads and recloses the circuit as soon as the overload is removed, so that the use of these limiters in electric drill circuits will cut down fuse renewals and avoid the loss of time in making these renewals, it is claimed. Also, by instantly cutting off the motor circuit, it will prevent drill breakages and save the motor from overheating.

Porcelain Locking Sockets and Receptacles

The General Electric Company has brought out an improved line of porcelain locking sockets and receptacles for use in places where the socket is exposed to corroding influences such as acid, fumes, moisture, etc. A lamp installed out of doors, in the cellar or some similar place is most likely to be stolen, hence the need of the locking socket. Sockets installed in such places are most likely to be subjected to corroding influences, necessitating the use of porcelain locking sockets. These sockets take the standard G-E locking socket interiors and are therefore interchangeable in porcelain and metal shells.

The principle of the design is such that when the key is removed the lamp swivels freely, preventing injury to either the lamp base or the socket if an attempt is made to remove the lamp without the key. The receptacles are furnished in both key and keyless types, with bases for cleat, concealed and molding work, as well as bases for 3¼-in. and 4-in. (8.2-cm. and 10.2-cm.) outlet boxes. Caps, bodies and bases are interchangeable.

Trade Notes

E. L. LINCOLN, INC., has removed its plant from Waterville, Me., to 534 Congress Street, Portland, Me.

S. ORRICK has been appointed assistant manager of the Western Electric Company at San Francisco, Cal.

EDWARD MOSER, Lehighton, Pa., connected with the municipal electric light plant as superintendent, died Nov. 8, at the age of fifty years.

LLOYD P. JONES, recently made vice-president and general manager of the Federal Brass Works, Detroit, was formerly sales manager.

A. S. LINDSTROM, formerly with the Western Electric Company, is now general manager of the Thordarson Electric Manufacturing Company, Chicago.

THE GENERAL ELECTRIC COMPANY, Boyd Street, Newark, N. J., has acquired property opposite its present plant, from Boyd to Lillie Street, and is said to be planning for plant extensions.

THE RAILWAY & POWER ENGINEERING CORPORATION, LTD., Toronto, Canada, has opened, temporarily, a "used-equipment department," where all equipment sold is subject to the customer's inspection.

C. H. FELKER, who for several months has been conducting the commercial work for the Columbus (Ohio) Railway, Power & Light Company, has resigned to become sales manager of the Home Specialty Company, Cleveland.

RAYMOND W. MURPHY, for the last nine years connected with the San Francisco and Los Angeles offices of the Westinghouse Lamp Company, has been transferred to the Philadelphia office in the capacity of assistant manager of that district.

ARTHUR H. D. ALTREE, branch manager of the Bosch Magneto Company, Chicago, Ill., for several years, and who in the early part of 1914 was transferred to the main office in New York as vice-president, has resigned, to take effect Jan. 15 next.

THE A. H. PETERSON MANUFACTURING COMPANY, Milwaukee, Wis., succeeds the P. & B. Manufacturing Company. It will continue to manufacture the "P. & B." products, and a substantial expansion along these lines will be announced in the near future.

W. F. TRENARY, JR., with headquarters in the Brown-Marx Building, Birmingham, Ala., now represents the Harrison Safety Boiler Works of Philadelphia, manufacturer of the Cochrane heaters and other steam-plant appliances, succeeding W. R. Jennison.

J. S. VEATCH has been appointed district sales agent of the Ohio Brass Company, Mansfield, Ohio, for the territory surrounding Denver, Col., where he will make his headquarters. C. A. Veatch, father of the new appointee, has for some years traveled a mid-West field.

SAMUEL L. MORSE & SONS CORPORATION, manufacturer of electric industrial trucks, has been absorbed by the Bethlehem Shipbuilding Corporation, Ltd., South Bethlehem, Pa. The new concern also acquires and leases several other companies at Eastern tidewater points and on the Pacific Coast.

THE PHILADELPHIA STORAGE BATTERY COMPANY, Philadelphia, has acquired the services of Walter E. Holland to take charge of special research work. For ten years he was connected with the Edison Storage Battery Company of Orange, N. J., in the position of chief electrical engineer.

THE SOUTHERN FERRO ALLOYS COMPANY, Chattanooga, Tenn., has its plant completed and in successful operation. It is considered a model of its kind. The Canada Carlide Sales Company, 30 Church Street, New York City, has been appointed the Southern company's exclusive sales agent.

J. W. WHITE has been appointed manager of the power and railways divisions of the Detroit office of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Mr. White, who was formerly connected with the Pittsburgh office of the company, subsequently being associated with the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has now returned to the Westinghouse service.

DR. MILTON W. FRANKLIN, Philadelphia, formerly engineer of the ozonator department of the General Electric Company, has resigned to become connected with the E. F. Houghton Company, 240 West Somerset Street, Philadelphia, as consulting engineer. Dr. Franklin will be a member of the board of directors of the company, chairman of the sales committee, and will have charge of plants, manufacturing processes and equipment.

THE UNIVERSAL MOTOR COMPANY of Oshkosh, Wis., has just completed a two-story addition to its plant, 40 ft. by 180 ft., which is now occupied. The addition is of concrete construction and has a modern testing department built in, with all facilities for testing marine motors and generating sets. The machine department has been extended, many new machine tools being added, some of special design. The assembly department is also enlarged with many improved handling devices and equipment for the handling of the motors in process.

New Incorporations

THE ASHDOWN (ARK.) LIGHT & ICE COMPANY has been incorporated with a capital stock of $50,000 by M. B. Morgan, S. R. Morgan and J. D. Tatum.

THE PREMIER RUBBER & INSULATION COMPANY of Dayton, Ohio, has been incorporated with a capital stock of $100,000 by Henry M. Granzow and others.

THE GAS & ELECTRIC SCALES COMPANY of San Francisco, Cal., has been incorporated with a capital stock of $40,000 by Thomas Steel, M. J. Purcell, V. A. Kuehn, L. M. Olds and A. C. Duerr.

THE INDUSTRIAL ELECTRIC LIGHT & POWER COMPANY of Upper Milford, Allentown, Pa., has been chartered with a capital stock of $5,000. Charles M. Wagner is among the incorporators.

THE NATIONAL ELECTROPURE WATER COMPANY of Buffalo, N. Y., has been incorporated with a capital stock of $10,000 by Urban W. Hubertus, G. Lucene Fullington and Paul G. Stuart.

THE DORRITE INSULATION COMPANY of New York, N. Y., has been chartered with a capital stock of $200,000 by H. A. Dorr, C. O. Hall and R. D. Adams, 176 Broadway, New York, N. Y.

THE CECILTON (MD.) ELECTRIC LIGHT & POWER COMPANY has been incorporated by William H. Anderson, Enoch S. Short, William Luthringer, William H. Brown and B. Markley Black.

THE BRISTOL ELECTRIC COMPANY of Taunton, Mass., has been incorporated with a capital stock of $5,000. The officers are Leo E. Beauchamp, president; Albert E. Downey, treasurer, and Helen P. Hickey.

THE HAMMOND ELECTRIC BANK PROTECTION COMPANY of Los Angeles, Cal., has been incorporated with a capital stock of $250,000 by W. D. Hammond, C. E. Rees, W. I. Gilbert, F. C. Mason and B. N. Hammond.

THE ELECTRO-INDUSTRIAL TRACTOR COMPANY of Vernon, Los Angeles, Cal., has been chartered with a capital stock of $50,000, to manufacture tractors. Richard H. Norton, 335 West Twenty-seventh Street, is interested.

FIRTH & MARSHALL of New York, N. Y., have filed articles of incorporation with a capital stock of $100,000 to manufacture electrical appliances. The incorporators are: J. Firth, C. Marshall and H. Freece, 35 Wall Street, New York, N. Y.

THE MILWAUKEE (WIS.) ICE MACHINE COMPANY has been chartered with a capital stock of $50,000 to manufacture a new line of refrigerating machinery and equipment. The incorporators are: Edwin Olsen, Fred Marggraff and Fred Ferko.

THE NEW YORK ROTARY MOTOR COMPANY of New York, N. Y., has been incorporated by A. M. Sullivan and A. S. Meyers, 60 Wall Street, New York, N. Y. The company is capitalized at $1,700,000 and proposes to manufacture motors, etc.

THE INTERNATIONAL SIGNAL COMPANY of Wilmington, Del., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $2,500,000. The company proposes to manufacture and deal in electrical devices for messages and signaling.

THE MAZDA ELECTRIC MANUFACTURING COMPANY of St. Louis, Mo., has been incorporated by J. M. McKernan, D. W. Hutchinson, Maude McKernan and M. Hutchinson. The company is capitalized at $2,000 and proposes to do a general manufacturing business.

ELLIOTT RAPPAPORT of New York, N. Y., has filed articles of incorporation, with a capital stock of $10,000, to do a general electrical and mechanical engineering and contracting business. The incorporators are: A. J. Rosenthal, S. Elliott and A. Rappaport, 200 West Twenty-first Street, New York, N. Y.

THE BROWN'S MILLS ELECTRIC LIGHT & POWER COMPANY of Jersey City, N. J., has been incorporated by J. Haviland Tompkins, John R. Turner and C. H. Jarvis of Jersey City. The company is capitalized at $50,000. The office of the company is located at 15 Exchange Place, Jersey City, N. J.

THE GENERAL GAS-ELECTRIC PLANT COMPANY of Fargo, N. D., has been incorporated with a capital stock of $25,000 to manufacture and install gas and electric plants; also to generate and distribute electricity and gas for lamps and motors. Fred Schulze and A. L. Costello of Bismarck are interested in the project.

THE BOWEN PRODUCTS CORPORATION of Auburn, N. Y., has been chartered with a capital stock of $2,500,000 to manufacture machinery, engines, motors, etc. The incorporators are: W. B. Reynolds, 240 West 102d Street, New York.; A. F. Dillman of Maplewood, N. J., and E. T. Williams, 216 Brooklyn Avenue, Brooklyn, N. Y.

HAMILTON & HANSELL, INC., of New York, N. Y., has filed articles of incorporation with a capital stock of $100,000 to do a general surveying and electrical engineering business, also to act as commission merchants in oil, coal and gas enterprises. The incorporators are: R. S. O'Connell, J. G. Waldron and R. Elliott, 26 Park Row, New York, N. Y.

THE RECIPROCATING ELECTRIC TOOL COMPANY of Louisville, Ky., has been incorporated by J. J. Roberts, 412 Courier-Journal Office Building, Louisville, Ky.; James K. Jarvis, F. L. Robinson and J. D. Kean. The company is capitalized at $100,000 and proposes to buy parts for electrical drilling and riveting tools to be made in all sizes and assemble them in Louisville. Later a plant will be constructed to manufacture the parts.

Trade Publications

FUSES.—The Killark Electric Manufacturing Company of St. Louis, Mo., has prepared a leaflet descriptive of its automobile fuses.

SOOT CLEANERS.—The Vulcan Soot Cleaner Company of Dubois, Pa., has prepared a folder descriptive of its Vulcan soot cleaner.

TELEPHONES.—The Stromberg-Carlson Manufacturing Company of Rochester, N. Y., is mailing a folder announcing its new No. 896 wall telephone.

HEATING APPLIANCES.—The Rutenber Electric Company of Marion, Ind., has prepared a catalog descriptive of its electric ranges, irons, grills, radiators, etc.

HORN-GAP SWITCHES.—The Railway & Industrial Engineering Company of Pittsburgh, Pa., has issued a folder descriptive of its type "B" Burke horn-gap switches.

ELECTRICAL APPLIANCES. — The Hotpoint Electric Heating Company of Ontario, Cal., is distributing a folder descriptive of its popular magazine advertising campaign.

OUTDOOR CABLE TERMINALS.—The Standard Underground Cable Company of Pittsburgh, Pa., has prepared bulletin No. 700-2, descriptive of its type D. O. A. patented outdoor cable terminal.

INSULATING MATERIAL — The Condensite Company of America, Bloomfield, N. J., has prepared a catalog descriptive of its insulating material known as condensite. This catalog outlines the many uses of the material and tells what it is.

PRIMARY CUT-OUT.—The G. & W. Electric Specialty Company, Chicago, is issuing a bulletin illustrating and describing the operation of the S. & H. oil-submerged compression cut-out. This is a primary cut-out, taking advantage of both compression and oil submersion in its operation.

ELECTRICAL APPARATUS —The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared several bulletins descriptive of electrical apparatus. One of these bulletins is descriptive of its four-frame motors, type CS; another of its magnetic brakes for alternating-current motors, type A; a third of Cutter universal floodlighting projectors; a fourth of its type C induction feeder-voltage regulator for outdoor service, and the fifth is a leaflet, or catalog 4-A, on distributing transformers. The last-named bulletin includes information on its single-phase 60-cycle transformers.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

BOSTON, MASS.—The Edison Electric Illuminating Company, 39 Boylston Street, has filed plans for the erection of a new five-story substation on Chauncey Street. Contract has been awarded to the George E. Macomber Company, 44 Bromfield Street, Boston.

SOMERVILLE, MASS.—The Springfield Provision Company has awarded a contract to the Casper Ranger Company, 20 Bond Street, Holyoke, for extensions and alterations in its local power house.

NEWPORT, R. I. — Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to Westinghouse, Church, Kerr & Company of New York, N. Y., for the construction of a power plant at Newport, to cost about $900,000.

NORWICH, CONN.—A certificate of organization has been filed in the office of the Secretary of State by the Eastern Connecticut Power Company of Norwich. The company, which is capitalized at $1,000,000, is owner of what is known as the air power hydraulic privilege on the Quinnebaug River and also of the Bunday Hill water privilege on the same river. The company proposes to develop these two privileges as soon as conditions are such as to warrant the expenditure. The present plans provide for the construction, in the immediate future, of a large steam-driven power plant at Thamesville, which will furnish energy to operate the new shipyard in Groton known as the Groton Iron Works, to be supplied through the Shore Line Electric Railway Company, which will distribute electricity generated by the Eastern Connecticut Power Company.

PUTNAM, CONN. — Contract has been awarded by Otto Heineman Phone Supply Company, 25 West Forty-fifth Street, New York, N. Y., for the construction of a two-story addition, about 40 ft. by 140 ft., to its local plant.

WATERBURY, CONN.—The Connecticut Light & Power Company, 111 West Main Street, has commenced the erection of a new power house and dam at Stevenson, Conn. The J. A. P. Crisfield Contracting company, corner of Broad and Arch Streets, Philadelphia, Pa., is in charge of the work.

Middle Atlantic States

BROOKLYN, N. Y. — Plans have been prepared for the erection of a new machine shop, 35 ft. by 70 ft., one story, at the foot of Court Street, for the Electric Welding Company, 801 Vernon Avenue, Brooklyn.

BROOKLYN, N. Y.—Contract for the construction of two new intake tunnels on Sixty-sixth Street has been awarded by the Edison Electric Illuminating Company, 13 Willoughby Avenue, to the General Contracting & Engineering Company, 29 Broadway, New York.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until Dec. 10, for repairs and alterations made necessary by recent fire at the Commercial High School, Albany Avenue, Bergen and Dean Streets, Brooklyn, as follows: (1) Repairs and electrical work, etc.; (2) sanitary work, etc. Bids will also be received at the same time and place for a portable school building to be erected on Mermaid Avenue between West Thirty-first and West Thirty-second Streets, as an annex to Public School 80, borough of Brooklyn, as follows: (1) General construction; (2) plumbing and draining; (3) heating and ventilating; (4) electrical work. Blank forms, plans and specifications may be seen or obtained at the above office and also at branch office, 131 Livingston Street, Brooklyn.

BUFFALO, N. Y.—The Donner Steel Company, 475 Abbott Road, is considering the construction of an addition to its power house.

BUFFALO, N. Y.—The Buffalo Union Furnace Company, Katherine Street, is considering alterations in its power house, to cost about $14,000.

BUFFALO, N. Y.—Contract has been awarded by the Delaware, Lackawanna & Western Railroad Company, 90 West Street, New York, to the Durolithic Construction Company, Ellicott Square, Buffalo, for the erection of a new one-story power house at its East Buffalo works.

BUFFALO, N. Y.—The Kellogg Products Company, 98 Delaware Avenue, has awarded a contract to B. I. Crooker, 57 Builders' Exchange, Buffalo, for the construction of two new additions to its plant at 1317 Elk Street, to consist of a two-story power house, 30 ft. by 112 ft., and a two-story transformer house, about 35 ft. by 65 ft.

CENTRAL ISLIP, N. Y.—Contract for the proposed new power plant at the Central Islip State Hospital has been awarded by the State Hospital Commission to Benjamin Raynor, Locust Avenue, Islip, at about $150,000.

EAST UTICA, N. Y.—The Utica Gas & Electric Company has filed plans for the erection of a new one-story substation at its plant, to cost about $12,000. Contract has been awarded.

LE ROY, N. Y.—The property of the Le Roy Power & Milling Company is to be absorbed by the Le Roy Hydraulic Electric Gas Company, and the present flour and feed mill on Mill Street will be discontinued. The electric company expects to dismantle the mills and convert the building into a substation, utilizing water power from Oakta Creek.

LOCKPORT, N. Y.—The Niagara County Commissioners are considering the construction of a new electric lighting plant on the old almshouse site. Frederick H. Krull, clerk.

MACEDON, N. Y. — A committee has been appointed to investigate the feasibility of the town purchasing the electric plant of the Macedon Milling Company. Should the plant be purchased, an expenditure of considerable money would be required for improvements. The plant now furnishes electricity for operating the municipal street-lighting system.

NEW YORK, N. Y.—The New York Edison Company will build a new one-story brick addition, 40 ft. by 65 ft., to its transformer station, at Park Avenue and One Hundred and Eighty-ninth Street, at a cost of $15,000. Plans are being prepared by George F. Kiess, 130 East Fifteenth Street.

TROY, N. Y.—The water rights of the Troy Knitting Company have been purchased by the Fuld & Hatch Knitting Company, which will have the same transferred to the Ogden Mill, which the company has leased from the Harmony Mills.

UTICA, N. Y.—The City Council has adopted an ordinance directing the Utica Gas & Electric Company to erect 50 additional electric lamps in different locations directed by the commissioner of public works and the committee on street lighting.

UTICA, N. Y.—The Bossert Company, Hickory Street, Utica, manufacturer of stamped metal goods, electrical switch boxes, etc., is contemplating the construction of an addition to its plant, about 40 ft. by 70 ft., and a boiler house, 20 ft. by 80 ft.

WATERTOWN, N. Y. — Preliminary plans are being prepared by the S. M. Greene Company of Springfield, Mass., architect and engineer, for the construction of a municipal power plant about 1½ miles from the city, to cost about $300,000. J. W. Knowlton is president of the water board.

WINGDALE, N. Y.—Bids will be received by the Commission on New Prisons, Room 18, Hall of Records Building, Center and Chambers Streets, New York City, until Dec. 20, for construction, heating, sanitary and electric work for cell house, interlocking building, mess hall and central heating and lighting plant, and underground piping and conduit work, underground sewer and water construction and underground electric service connections, at Wingdale Prison, Wingdale. Drawings and specifications may be consulted at the office of the Commission on New Prisons, Room 618, Hall of Records, New York City; New York office of the Department of Architecture, Room 1224, Woolworth Building, and Department of Architecture, Capitol, Albany, N. Y. Drawings and specifications may be obtained at the Department of Architecture, Capitol, Albany, upon deposit of $10.

WORCESTER, N. Y.—The local electric-light plant, owned by Harry Shafer, has been purchased by the Schoharie Light & Power Company of Esperance. The new owners will take possession of the system next spring and will establish a 24-hour service.

YONKERS, N. Y.—Contract has been awarded by the Single Service Packing Company of America, 326 Hudson Street, New York City, to Michael Doherty, 13 Rose Street, New Rochelle, for the construction of a one-story power house on the Saw Mill River Road, Yonkers, which, with the erection of another building, will cost about $30,000.

ATLANTIC CITY, N. J.—The Public Utility Commission has given its approval of the petition of the Pleasantville Heat, Light & Power Company to surrender its lease to the Atlantic City (N. J.) Suburban Gas & Fuel Company on condition that the latter company will immediately operate both the gas and electric plants to supply consumers of the Pleasantville company.

BAYONNE, N. J.—The Bayonne Steel Casting Company is contemplating the construction of a new one-story brick substation at its plant at Oak Street and Ingham Avenue.

BURLINGTON, N. J.—Plans have been prepared by Haines & Sherman, 415 Market Street, Camden, engineers, for the construction of a new municipal electric-light plant in Burlington, for which bids will be asked in the near future.

JERSEY CITY, N. J.—Bids will be received until Dec. 18 by the County Park Commission for the lighting of Bayonne Park, Bayonne, N. J. Walter G. Muirheid, secretary.

JERSEY CITY, N. J.—The Boulevard Commission has petitioned the Board of Freeholders for an appropriation of $150,000 for the purpose of rebuilding the commission's lighting plant at Snake Hill.

JERSEY CITY, N. J.—Contract has been awarded by the city officials for alterations and additions to the power house at the City Hospital to W. H. & F. W. Cane, Woolworth Building, New York City.

JERSEY CITY, N. J.—The Central Railroad of New Jersey, Communipaw Avenue, has filed plans for the construction of its proposed new one-story power plant, to cost about $150,000. Contract has been awarded to the Westinghouse, Church, Kerr Company, 37 Wall Street, New York.

LINDEN, N. J.—A petition has been presented to the Township Committee by the citizens and taxpayers asking that electric lamps be placed on Eleventh Street.

NEWARK, N. J.—The Butterworth-Judson Company has taken out a permit for the construction of a new one-story boiler plant addition to its work on Avenue R, to cost about $15,000.

NEWTON, N. J.—Contract has been awarded by the Town Council to the Newton Electric & Gas Company for furnishing service for street lighting for a period of one year, effective Jan. 1.

RED BANK, N. J.—Plans are being prepared for extensions and alterations in the power plant at the works of the Roberts Safety Tube Boiler Company. The H. D. Best Company, 52 Vanderbilt Avenue, New York, N. Y., is architect.

TRENTON, N. J.—Plans have been filed by the Delion Tire & Rubber Company for the construction of a two-story power house addition, about 35 ft. by 55 ft., to its plant on Whitehouse Road. Contract has been awarded to J. H. Morris, Broad Street Bank Building, Trenton.

ALLENPORT, PA. — Work has begun on the erection of a one-story, 32-ft. by 83-ft. substation at the plant of the Pittsburgh Steel Products Company, Frick Annex Building, Pittsburgh. The cost of the building is estimated at $15,000.

ALTOONA, PA.—Work has begun on the construction of a large plant in which the Pennsylvania Railroad Company will mix all its own lubricating oils, greases and signal oils for the lines east of Pittsburgh and Erie. Thirty-one steel storage tanks, ranging from 1000 to 125,000 gallons each, will be erected. The plant will be equipped for electrical operation.

BENSON, PA.—Application has been made to the Public Service Commission by the borough officials for permission to acquire and operate the electric plant of the White Oak Electric Company.

BENTLEYVILLE, PA. — The Borough Council is considering the installation of a new street-lighting system, the cost not to exceed $1,000. The plans call for six 250-cp. incandescent lamps on the main thoroughfare and a large number of 80-cp. lamps on the avenues and alleys. The West Penn Electric Company (Charleroi division) furnishes electrical service in Bentleyville.

BETHLEHEM, PA.—The Bethlehem Silk Company is planning to equip its plant, at 15 Goepp Street, for electrical operation throughout.

CARNEGIE, PA.—The Aetna Chemical Company has awarded contract to the W. W. Lindsay Company, Harrison Building, Philadelphia, for a new power house and 100-ft. radial brick stack at its works.

HAMBURG, PA.—D. J. Criscoll, of Reading, is planning for the installation of an

electrical smelting system for the production of ingots in the new foundry now being erected at Hamburg.

JOHNSTOWN, PA.—Plans for the extension of the car line of the Johnstown Traction Company through the Seventeenth Ward to Constable Hollow have been approved by the Public Service Commission.

JOHNSTOWN, PA.—The plant and holdings of the Dale Light, Heat & Power Company of Johnstown will be sold on Dec. 15 at the court house, Ebensburg. The sale will include a piece of land in Stonycreek, all rights, franchises, etc. The company supplies electricity for street-lighting and domestic purposes in the borough of Dale, Walnut Grove and in portions of the city of Johnstown and also to several industrial concerns in this district.

LANCASTER, PA.—The auxiliary electric power plant of the Lancaster Electric Light, Heat & Power Company, located at Wabank, about 5 miles from Lancaster, was recently destroyed by fire, causing a loss of about $30,000.

MILLERSBURG, PA.—Governor Brumbaugh has approved the consolidation of seven electric companies, incorporated to operate in Dauphin, Juniata and other counties into the Juniata Public Service Company of Clearfield. The company is capitalized at $346,000, and will operate from Millersburg.

PHILADELPHIA, PA. — Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to the Commercial Engineering Company, 1527 Sansom Street, Philadelphia, for the installation of an electric system at the local navy yards, to cost about $25,000.

PHILADELPHIA, PA. — The DeLong Hook & Eye Company, Broad and Wallace Streets, has filed plans for the erection of a new one-story power house at Twenty-first and Clearfield Streets. The company will also build a new factory building at the same location, and the entire work will cost $250,000. Contract for construction has been awarded to William Steele & Son, 30 South Fifteenth Street, Philadelphia.

PITTSBURGH, PA.—The Miller-Owen Electric Company, 217-19 First Avenue, will build a new one-story addition, about 40 ft. by 200 ft., to its plant, to cost about $40,000. Plans have been prepared by the C. D. Cooley Company, Century Building, Pittsburgh.

TROY, PA.—The John Waldo Evaporated Milk Company has awarded a contract to Pulford & Pompsey, 157 Falck Street, Elmira, N. Y., for construction of an addition to its power house.

ANNAPOLIS, MD.—The Bureau of Yards & Docks, Navy Department, will make extensions to its electric power, water and heating systems at the Naval Academy. Plans for the work, which will cost about $500,000, are being prepared. F. R. Harris is chief.

BALTIMORE, MD.—Contract has been awarded by the Poole Engineering Company to the H. D. Watts Company, Garrett Building, Baltimore, for the construction of a two-story reinforced concrete and brick electric substation, 35 ft. by 55 ft.

CAMERON, W. VA.—A franchise has been granted to W. V. Smith to furnish electricity in Cameron.

CHARLESTON, W. VA.—The Charleston-Dunbar Traction Co. is planning to extend its lines from Dunbar, the present terminus, to Sattes, the new town to be constructed by the E. I. DuPont de Nemours Powder Company on 1200-acre site, in connection with a large plant for the manufacture of powder and munitions. The plant and the surrounding town will require a large amount of electrical energy.

CLUTE, W. VA.—The Hawley Coal Company is considering the erection of a large new power house at its plant. W. P. Hawley, Bluefield, is president of the company.

MORGANTOWN, W. VA.—Arrangements have been completed whereby the West Virginia Traction & Electric Company will purchase energy from the Monongahela Valley Traction Company. The erection of an electric transmission line between Fairmont and Morgantown is under way.

ST. MARYS, W. VA.—The St. Marys Light & Power Company will build a new one-story electric lighting plant, about 50 ft. by 65 ft. Plans have been prepared by R. H. Adair, 501½ Juliana Street, Parkersburg.

RICHMOND, VA.—A special meeting of the stockholders of the Virginia Railway & Power Company has been called for Dec. 29 for the purpose of ratifying the action of the directors authorizing the expenditure of $1,000,000 for the erection of additional electric transmission lines.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Various, Schedule 1581—72 motor-generator sets. Brooklyn, N. Y., Schedule 1572—15 motor-driven sounding navigating machines; Schedule 1575—2000 boiler tubes, 4 in. (outside diameter) by 18 in. long. Portsmouth, N. H., Schedule 1580 — six portable ventilating sets. Washington, D. C., Schedule 1573 — miscellaneous brass seamless-drawn tubing. Application for proposals should give the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, for furnishing at the various navy yards and naval stations supplies as follows: Puget Sound, Wash., Schedule 1591—2000 ft. single-conductor copper cable, 15,000 ft. incandescent lamp cord, 6000 ft. lighting and power wire, 400 ft. three-conductor, rubber-covered wire; Schedule 1592—1500 ft. two-conductor electric wire; Schedule 1593—62,000 ft. lighting and power wire, miscellaneous single-conductor lighting and power wire, 20 lb. nickel chromium resistance wire, 550 lb. magnet wire. Various, Schedule 1593—27,500 ft. interior communication wire; Schedule 1604—miscellaneous dry cells. Brooklyn, N. Y., Schedule 1591—400,000 ft. ship lighting cable, 225,500 ft. rubber-insulated, single, lead-covered wire, 350,000 ft. duplex, rubber-covered wire; Schedule 1593—70,000 ft. fire-control telephone cord, 12,000 ft. high-tension wire, 250,000 ft. plain, single-conductor wire, 45,000 ft. plain, single-conductor wire; Schedule 1598—motor generator sets; Schedule 1592—750,000 ft. bronze silicon antenna wire. New Orleans, La., Schedule 1593—60,000 ft. armored and leaded wire, 50,000 ft. double-conductor portable wire, 20,000 ft. two-conductor wire. Application for proposal blanks should designate the schedule desired by number.

North Central States

IRON RIVER, MICH.—The erection of a power house and car barn is contemplated by the Iron River, Stambaugh & Crystal Falls Street Railway Company.

PORT HURON, MICH.—Plans are being prepared by the Mueller Manufacturing Company of Sarnia, Ont., for the construction of a power house, 60 ft. by 100 ft., in connection with its new plant being erected in Port Huron. The cost of the plant complete is estimated at about $400,000. James, Loudon & Hertzberg of Toronto, Ont., are consulting engineers.

CALEDONIA, OHIO.—Bonds to the amount of $10,000 have been sold, the proceeds to be used for the establishment of a municipal electric light and power plant.

CANTON, OHIO.—The Republic Stamping & Enameling Company is installing an electric power plant of sufficient capacity to operate its entire plant. Heretofore electricity has been secured from the Central Power Company of Canton.

CHARDON, OHIO.—Bonds to the amount of $25,000 have been voted for the installation of a new electric-light plant. The machinery in the present plant, which has been in use 20 years, is worn out. Plans have been prepared by E. C. Thompson, engineer.

CINCINNATI, OHIO.—The Central Avenue Improvement Association has petitioned the city authorities to install ornamental lamps on Central Avenue.

CINCINNATI, OHIO.—A permit has been filed by the P. W. Drackett Sons Company for the erection of a power house on Spring Grove Avenue, north of Mitchell, to cost about $7,000.

CINCINNATI, OHIO.—The New Courthouse Building Commission of Hamilton County, Cincinnati, will receive bids until Dec. 18 for the installation of lighting fixtures in the new courthouse and jail now under construction in Cincinnati. Plans and specifications are on file at the office of Rankin, Kellogg & Crane, architects, 1012 Walnut Street, Philadelphia, Pa., and at the office of the auditor of Hamilton County, Cincinnati.

CLEVELAND, OHIO.—Extensions, involving an expenditure of $700,000, will be made to the municipal electric light plant. New equipment, including switchboard, generator, boilers, engines, etc., will be installed.

CLEVELAND, OHIO. — Property purchased at East Fifty-fifth Street by the Pennsylvania Railroad Company will be used as a terminal. Two electrically operated cranes will be installed for handling freight. B. K. Rochester is superintendent of the Cleveland division.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, Cleveland, until Dec. 14, for structural steel work for the division of light and heat. Specifications may be obtained at the office of the division of light and heat.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, Cleveland, until Dec. 14, for furnishing, lighting, extinguishing, repairing and maintaining electricity for electric lamps for street lighting in the city of Cleveland for one year beginning Jan. 1, 1918. Specifications may be obtained at the office of the superintendent of street lighting.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, Cleveland, until Dec. 14 for 14-in. and 16-in. boulevard glass globes for street lamps for the street-lighting division. Bids will also be received at the same time and place for ornamental glass globes for park and boulevard lamps for the street-lighting division. Specifications may be obtained at the office of the superintendent of street lighting, room 122, City Hall.

COLUMBUS, OHIO.—Plans are being prepared by Joseph N. Bradford, architect, Ohio State University, for six large agricultural buildings, to be erected on the campus, west of the Olentangy River, which will include a number of barns and administration buildings and a power plant.

DAYTON, OHIO.—The Dayton Metal Products Company is planning to build an addition to its plant on Taylor Avenue, to cost about $7,000. It will also install additional equipment to its electrical plant on Ludlow Avenue.

HAMILTON, OHIO. — Estimates have been prepared by Mead & Seaston, engineers, for enlarging the municipal electric-light plant. The plans provide for the installation of two new boilers; changing the ash and coal-handling apparatus; installing new gas grates under present boilers, and that a new steam-driven generator of at least 1250 kva. should be installed immediately. The substitution of Mazda type of lamp for the arc lamps now in use is recommended.

TOLEDO, OHIO.—The Northwestern Ohio Railway & Power Company is planning to erect a new transmission line from Danbury Stop to Danbury, a distance of 1½ miles, to supply electricity to a large pumping station of the New York Central Railroad Company. The company will also install an additional transformer at its station. The New York Central Railroad will pay the entire cost of erection of the transmission line and the cost of one-third of the wire from Danbury Stop to Danbury, and will also pay one-half of the cost of the transformer.

COVINGTON, KY.—The proposed contract for installing electrical machinery at the water-works pumping station has been submitted to the City Commission. The Union Light, Heat & Power Company will install the new pumping machinery and electric motor at a cost of $36,000 and will take payment in installments in the way of water rental. The company uses a large amount of water in supplying the citizens of Dayton and Bellevue, which is purchased from the Covington plant.

CYNTHIANA, KY.—The Kentucky Traction & Terminal Company of Lexington is erecting an electric transmission line from Georgetown to Cynthiana, which, it is expected, will be completed about Feb. 1, 1918. The local plant will be closed down upon completion of the line.

FAIRFIELD, KY.—The electric plant of the Fairfield Electric Company was recently destroyed by fire.

LEXINGTON, KY.—The American Metallic Packing Company would like to receive prices on a second-hand generator, 100 to 150 kw., 250 or 500 volts, complete; must be in first-class condition.

CROMWELL, IND.—The local electric-light plant and sawmill, owned by W. Moore & Company, was recently destroyed by fire, causing a loss of about $7,000.

MARTINSVILLE, IND. — The capital stock of the Martinsville Gas & Electric Company has been increased from $150,000 to $200,000.

STEUBENVILLE, IND. — The capital stock of the Buckeye Power Company has been increased from $9,000 to $2,241,000.

CHICAGO, ILL.—Preparations are being made by Marshall Field & Company for the erection of a garage, for which bids are now being received by Graham, Anderson, Probst & White, 80 East Jackson Boulevard, Chicago. The building will be one and two stories and will cost about $400,000.

GROVE, ILL.—The Grove & Morton Railway Company has petitioned the Public Utilities Commission for a certificate of

convenience and necessity to construct and operate an electric railway between Grove and Morton.

SAN JOSE, ILL.—The local electric-light plant, owned by S. B. Hullinger, was recently destroyed by fire, causing a loss of about $30,000.

SHERIDAN, ILL.—Application has been filed with the State Utilities Commission by the Sheridan Electric Light & Power Company for a certificate of necessity and convenience to operate at Sheridan. The company also asks for permission to sell $3,000 in bonds.

VIENNA, ILL.—Application has been made to the City Council by J. J. Oelrich for a franchise to construct and operate an electric-light and power plant in Vienna.

GLIDDEN, WIS.—The Northern Wood Products Company is planning to erect an addition to its hardwood factories and power plant, to cost about $40,000. W. A. Thomas is president and general manager.

KANKANNA, WIS.—The Kankanna Electric Light Company is planning to extend its electric transmission lines to Fairview Heights, the new addition of Little Chute.

KIEL, WIS.—Bids, it is reported, are being received by Charles A. Cahill, 1426 Trist National Bank Building, Milwaukee, for a 250-kw. generator and for motors, ranging from 5 hp. to 50 hp., for the Kiel (Wis.) Woodenware Company.

EDGERTON, MINN. — The Northern States Power Company of Chicago, Ill., has been awarded a contract for lighting the streets of the city and for furnishing electricity to operate the city pumping station for a period of ten years.

FORT MADISON, IOWA.—A movement has been started to install an ornamental lighting system on Second Street. It is proposed to have the Fort Madison Electric Company install the lamps.

GARNER, IOWA.—The local plant of the Iowa Falls Electric Company was damaged by fire recently, causing a loss of about $10,000.

MORNING SUN, IOWA.—The Burlington (Iowa) Railway & Light Company has applied to the City Council for a franchise to supply electricity in Morning Sun. The company is contemplating erecting an electric transmission line north from Burlington, connecting up Mediapolis, Morning Sun, Wapello and Winfield, giving each city a 24-hour service.

VAIL, IOWA.—At an election held recently the proposal to issue $11,000 in bonds to install an electric-lighting system in Vail was carried. Energy to operate the system will be secured from the municipal plant at Denison.

GRANT CITY, MO.—The local electric-light plant, owned by W. C. Childers, has been purchased by the Maryville (Mo.) Electric Light & Power Company, which has taken possession of the plant. Electricity, it is reported, will be supplied by the Maryville plant as soon as the right of way can be secured and the transmission line erected, which will probably take about 12 months.

ST. JOSEPH, MO.—That an expenditure of $31,000 for improvements to the municipal electric-light plant would enable the plant to take care of the ornamental lighting system, consisting of 247 lamp standards, the lamps in the boulevards and parks and between 75 and 100 lamps additional, was claimed in a statement made by Mayor Elliot Marshall recently. The boiler capacity of the plant is 850 hp. and the engine capacity only 350 hp.

SCRANTON, N. D.—The Johnson Fuel Company of Fairfax, S. D., which operates a briquetting plant in Scranton for the consumption of lignite, is contemplating the installation of an electric-light and power plant at its mine to utilize waste in the briquetting process. Electricity for lamps and motors will be supplied to Bowman, Marmarth, Rhame and Scranton.

AURORA, NEB.—The city of Aurora is in the market for a new pumping head and working barrel to be installed in a well in the city water-works plant. Pump to supply about 200 gal. per minute and to be motor-driven. Details of the well may be obtained from the city clerk or from the Aurora Electric Company. A. L. Hickman is manager of the Aurora Electric Company.

BAYARD, NEB.—Bonds to the amount of $4,500 have been voted for the installation of an ornamental street-lighting system.

CALDWELL, KAN.—The Council has adopted a resolution providing for the extension to the street-lighting system.

EL DORADO, KAN.—The property of the El Dorado Electric & Refrigerating Company has been purchased by the E. B. Lawson interests. The plant, it is understood, is to be enlarged.

TIPTON, KAN.—A company recently organized by local capitalists has installed an electric-light plant in Tipton. The plant has been placed in operation and a 24-hour service established.

Southern States

PARKTON, N. C.—The City Council is considering an issue of $5,000 in bonds for the installation of an electric-lighting system. F. N. Fisher is Mayor.

SOUTHPORT, N. C.—Contract has been awarded by the city of Southport to Price Furpless and Robert T. Woodside for the erection of an addition to the municipal power plant at the water-works. Orders have been placed for an engine, etc.

CHARLESTON, S. C.—The Charleston Consolidated Railway & Lighting Company is planning to erect a rotary converter substation on Clement's Ferry Road, between Five-Mile House Curve and Oaks Curve. The proposed building will cost about $30,000 and it will have a capacity of 700 hp. and will supply electricity to the suburban railway. Energy will be delivered to the station at three-phase, 13,200 volts, and converted to 440 volts, direct current. Later it is proposed to change it to an automatic station throughout.

COLLINWOOD, TENN.—The Tennessee Valley Iron & Railroad Company is planning to build a furnace with a daily output of 100 tons of charcoal iron. The plans provide for the erection of furnace stock and hoist, 50 ft. by 80 ft.; cast house, 50 ft. by 130 ft.; engine house, 40 ft. by 80 ft., and boiler house, 40 ft. by 80 ft., to be equipped with six boilers. The company will erect 30 dwellings equipped with water supply, electric lights and steam heat. D. E. Teed of Collinwood is engineer. C. N. Brady is president.

COLUMBIA, ALA.—The Houston Power Company, recently organized, proposes to build a hydroelectric plant in Columbia. H. F. Deal is president.

MARION, ALA.—Preparations, it is reported, are being made by the Alabama Power Company of Birmingham for installing a permanent plant on the site of the Marion Electric Company's plant, recently destroyed by fire.

VIDALIA, MISS.—The Southern Railway & Light Company of Natchez is planning to furnish electrical service (24 hours) for lamps and motors, etc., in Vidalia.

AMARILLO, TEX.—The City Commission has under consideration plans for the construction of a municipal electric light plant here. The proposition of voting $200,000 bonds for the purpose will probably be submitted to the taxpayers soon.

DALLAS, TEX.—The City Commission has authorized the Dallas Power & Light Company to borrow $4,000,000 and to issue 18,500 shares of stock with a par value of $100 each. It is stated that 6 per cent. notes will be issued for the loan.

Pacific and Mountain States

AUBURN, WASH.—The City Council has granted a franchise to the Valley Gas Company to furnish electricity in Auburn.

BELLINGHAM, WASH.—The Lone Jack Mining Company contemplates the construction of a power plant, to cost about $20,000, at its properties near Glacier, Wash.

BELLINGHAM, WASH.—The City Council has awarded the contract for building a dam flume, consisting of 280 ft. of 42-in. creosoted wooden stave pipe, running from Prospect Street Bridge to the city power plant near the Bellingham Sash & Door Company's plant, at $4,339. The plant which it serves has been leased to the Bellingham Sash & Door Company and provides power for both that company's plant and the municipal pumping station on Maple Street.

BELLINGHAM, WASH. — Arrangements are being made to open the Cokedale Mines in Skagit County in the near future, and a contract has been awarded for the construction of a railroad to the property. The mine will be equipped with electrically operated machinery, contract for which has been awarded to the Puget Sound Traction, Light & Power Company of Bellingham, which will erect a transmission line to the mine as soon as material can be secured. A substation will also be erected at the mine.

COLVILLE, WASH.—H. R. Williams, manager of the Stevens County Power & Light Company, is authority for the statement that power will be furnished to the Valley magnesite fields in the early spring. The Stevens County Company is to supply electricity for lamps and motors to the Chewelah Magnesite Works, and is within half a mile of the Northwest Magnesite & American Mineral quarries. The Stevens County plant at Meyers Falls, on the Colville River, will be increased to its full capacity during the winter.

NEWPORT, WASH.—The properties of the Northern Idaho & Montana Power Company, including those at Newport, Wash., and Sandpoint, Idaho, and of the Oregon Power Company at Eugene, Ore., were sold on Nov. 13 by order of the Federal Court in Newport to John H. Roemer of Chicago, Ill., representing the reorganized companies. The total involved in the sale was $5,016,773.

TACOMA, WASH.—The City Light Department has been requested to arrange a petition for lighting a section of the North End, including the district on Cliff Avenue to the north line of North D Street, to the intersection of North First and Cliff through the alley and down by the Stadium High School, between I and J Streets, to the center of North Sixth Street and back to Yakima Avenue.

WALLA WALLA, WASH.—The Board of Commissioners of Walla Walla County has received an application from the Pacific Power & Light Company for a 50-year franchise to construct and operate transmission lines in Walla Walla County. The company plans to furnish light and power to a number of unincorporated towns in the county.

KLAMATH FALLS, ORE.—The large dam of the California-Oregon Power Company across the Klamath River at Copco, 45 miles from Klamath Falls, has been completed. The company plans to generate 26,000 hp. under the present development. An equal amount can be developed by the installation of additional units to the power plant. The construction of a smaller dam below the present one, which will bring the total development to 103,000 hp., is contemplated by the company. Electricity generated at the plant will be distributed throughout northern California and southern Oregon.

COPPEROPOLIS, CAL.—The local power station of the Sierra & San Francisco Power Company of San Francisco was recently destroyed by fire, causing a loss of about $35,000.

FRESNO, CAL. — Plans have been announced by A. G. Wishon, general manager of the San Joaquin Light & Power Corporation, for the development of the water power of the upper Kings River. The first power plant, which will be built as a unit, will be erected on the banks of Kings River, about 15 miles above Trimmer. Each plant will provide for at least three units, and the first plant will cost approximately from $1,500,000 to $2,500,000. The power plant will be 1100 ft. above sea level and will be located just above the far end of the Pine Flat reservoir as planned by the Kings River conservation district.

GRASS VALLEY, CAL.—Work has begun on the construction of a cold-storage plant that will have a daily capacity of 50 tons of ice per day, with 75,000 cu. ft. of storage space. The refrigerating plant will be operated by a large electric motor, which will be augmented by a steam plant, to be used as an auxiliary power. The plant is being built by local capital, and J. C. Jones of San Francisco, a refrigerating engineer, will have charge of construction.

LIVINGSTON, CAL.—The Livingston Farm Center has approved the resolution favoring the irrigation district plan recently indorsed by the directors of the County Farm Bureau, which provides that the drawings of the irrigated district be done by the electricity generated by power from the Merced River and from storage water, and also that the irrigation district have its own power and telephone system.

PALO ALTO, CAL.—The City Council is considering the question of increasing the output of the municipal electric-light plant. It will be necessary either to install new engines or purchase energy.

BISBEE, ARIZ.—The City Council, we are informed, does not contemplate calling an election to vote on the proposal to issue $375,000 in bonds for the construction of a new electric-light plant, water-works system and a gas-generating system as reported in the issue of Nov. 17. The Bisbee Improvement Company furnishes electrical service in Bisbee.

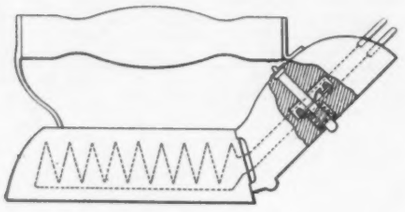
HOT SPRINGS, MONT.—Conrad Smith and F. E. Campbell, it is reported, are making arrangements to install a lighting and power plant in Hot Springs to serve the town and contiguous territory. The Town Council, it is understood, has agreed to grant them a franchise, and work will begin soon after the first of the year.

1,247,613. Electric Meter; John L. Axen, Detroit, Mich. App. filed Feb. 13, 1917. Provides a depolarizable instrument so constructed that the anomalous magnetic polarity produced by an excessive flow of current, as when the instrument is in a short circuit, will not have any permanent effect or influence on the normal resident polarity of the interrelated parts.

1,247,649. Electric Starting and Lighting System for Motor Vehicles; Albert E. Doman, Elbridge, N. Y. App. filed June 23, 1914. Involving the use of a compound-wound dynamo or motor and a storage battery as the sources of energy for such systems.

Record of Electrical Patents

Notes on United States Patents issued on November 27, 1917



1,247,907—Flatiron

1,247,650. Motor-Generator; Albert E. Doman, Elbridge, N. Y. App. filed July 27, 1914. Reduces the weight and at the same time increases the strength and durability of the case or housing, without sacrificing its magnetic efficiency.

1,247,656. Terminal for Conductors; William Gadke, Philadelphia, Pa. App. filed Jan. 22, 1916. Cannot easily be detached.

1,247,660. Swivel Contact for Electrical Conductors; Flint Garrison, St. Louis, Mo. App. filed Dec. 6, 1916. Improvement.

1,247,669. Telephone-Exchange System; Charles L. Goodrum, New York City, N. Y. App. filed July 15, 1915. Applies particularly to circuit arrangements for selector switches employed in automatic telephone systems.

1,247,672. Telephone Conductor; Claus W. Hallberg, Chicago, Ill. App. filed March 29, 1915. Particularly designed for conductors leading to a portable telephone set (transmitter and receiver).

1,247,676. Fire-Alarm Signaling Apparatus; Charles A. Harsch, New York City, N. Y. App. filed April 30, 1917. Useful in large buildings having several stories or floors, one above another.

1,247,689. Reef Alarm for Ships; John L. Kerchey, Schaghticoke, N. Y. App. filed Feb. 26, 1917. Attachment for ships.

1,247,690. Electric Switch; Charles J. Klein, Milwaukee, Wis. App. filed April 28, 1911. Push-button flush.

1,247,694. Electrolytic Apparatus; Isaac H. Levin, Newark, N. J. App. filed Oct. 25, 1915. Improvements in apparatus of the filter-press type.

1,247,741. Electric Welding Apparatus; Albertis C. Taylor, Warren, Ohio. App. filed July 23, 1917. Transformer having two independent secondary coils or bands and a single primary coil, whereby two independent secondary welding currents may be obtained with a single primary current.

1,247,751. Switch; John A. Van Alstyne, Sacramento, Cal. App. filed May 5, 1917. Electric starting.

1,247,753. Table Lever for Electric Signaling Apparatus; Eugene W. Vogel, Oak Park, Ill. App. filed July 18, 1914. Improvements.

1,247,759. Rectifier; Albert Wehmeier, St. Louis, Mo. App. filed Aug. 16, 1916. For deriving from an alternating current a direct form of current suitable for the charging of storage batteries and the like.

1,247,770. Automatic Telephone System; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed Jan. 31, 1916. Type in which switching apparatus at the central office acts automatically to find and make connection with a calling subscriber's line.

1,247,771. Automatic Telephone System; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed Jan. 31, 1916. Switch mechanism first selects a group in which the calling line is located and then finds the particular line in that group that is calling.

1,247,796. Telephone Switch; William W. Dean, Rochester, N. Y. App. filed April 13, 1916. Improvements.

1,247,800. Electrode Grip Handle; Walter H. Earnest, Meadville, Pa. App. filed April 18, 1917. Permits the electrode to be held in various positions in an easy and efficient manner.

1,247,820. Electric Socket; David D. Gordon, Chicago, Ill. App. filed Nov. 6, 1915. Two-part insulating construction the parts of which are locked together in assembled relation by the attaching of an incandescent lamp, a connecting plug or other device thereto.

1,247,825. Moisture and Gas Proof Telephone Case; Charles E. Hague, Rochester, N. Y. App. filed July 8, 1914. For use in mines.

1,247,831. Telephone System; Harvey L. Harris, Rochester, N. Y. App. filed March 20, 1917. Initiates a characteristic signal, individual to the operator's attention, to recall.

1,247,842. Switch Mechanism; Bertrand G. Jamieson, Chicago, Ill. App. filed Aug. 5, 1915. Remote control.

1,247,887. Telephone System; Frank M. Slough, Rochester, N. Y. App. filed Feb. 3, 1917. Improvements.

1,247,907. Flatiron; Francis W. Tully, Brookline, Mass. App. filed April 9, 1917. Improvements.

1,247,916. Connection Terminal; Alfred H. Weiss, Wilmette, Ill. App. filed Sept. 30, 1915. Locking means.

1,247,946. Automatic Switch; Ervin M. Fitz, Worthington, Ohio. App. filed July 11, 1916. Maintains constant polarity of current at the brushes of generators having armatures driven in reverse directions.

1,247,956. Incandescent Electric Lamp; Clara A. Harrison, London, England. App. filed March 24, 1914. Relates to the renewing or refilling of electric incandescent lamps with wire or like filaments.

1,247,976. Line-Finder System; Alben E. Lundell, New York, N. Y. App. filed June 27, 1916. Telephone.

1,247,981. Indicator; George F. McLaughlin, San Francisco, Cal. App. filed Jan. 31, 1916. Passenger vehicles.

1,248,021. Automatic Switch; Walter Scribner, Columbus, Ohio. App. filed Dec. 14, 1915. Improvements.

1,248,059. Electric-Light Bulb and the Fittings Therein; Delbert R. Baity, Melbourne, Victoria, Australia. App. filed July 18, 1916. Improvements.

1,248,074. Combined Switchboard and Rheostat for Controlling the Charging of Electric Storage Batteries; William C. Carr, Buffalo, N. Y. App. filed June 12, 1912. Improvement.

1,248,084. Magnetic Apparatus; Kenneth L. Curtis, Boston, Mass. App. filed Feb. 12, 1915. For safeguarding electric circuits.

1,248,090. Fuse; Louis W. Downes and Ralph C. Patton, Providence, R. I. App. filed Feb. 26, 1917. Two or more fusible elements are connected together.

1,248,091. Fuse; Louis W. Downes and Ralph C. Patton, Providence, R. I. App. filed May 23, 1917. Refillable.

1,248,122. Electric Soldering Iron; William F. Hosford, Oak Park, Ill. App. filed Aug. 29, 1916. Heating element is cored out to receive a non-oxidizing, heat-conducting core.

1,248,130. Electrically Operated Speed-Limiting Device for Motor Vehicles; Heinrich M. Kammerhoff, Orange, N. J. App. filed April 17, 1916. Improved.

1,248,135. Lamp Socket; Charles J. Klein, Milwaukee, Wis. App. filed Nov. 9, 1914. Means for interlocking the sections of casings for lamp sockets, pendent switches and the like.

1,248,158. Telephone Receiver; Alexander Poloumordvinoff, Petrograd, Russia. App. filed June 3, 1912. Improvements.

1,248,159. Telegraph Apparatus; Edwin Pope, Quebec, P. Q., Canada. App. filed June 14, 1915. For sending and recording telegraph messages.

1,248,161. Electric Fixtures; Roy W. Purcell, St. Paul, Minn. App. filed Feb. 1, 1917. Pilot light.

1,248,176. Alternating-Current Magnet and the Like; Harry A. Sedgwick, Milwaukee, Wis. App. filed Feb. 20, 1915. Reduces the vibration of the attracted parts of alternating-current devices at the pivotal points thereof.

1,248,187. Lighting Fixture; Esmond M. Smith, New York, N. Y. App. filed Jan. 20, 1917. Globe bowl supported below a ceiling or other reflecting surface in such a manner that the supporting means are inconspicuous.

1,248,202. Electrical Receptacle; George B. Thomas, Bridgeport, Conn. App. filed Jan. 27, 1917. Molding receptacle adapted to receive attachment plugs of the jack-blade type.

1,248,203. Electric Switch; George H. Thomas, Bridgeport, Conn. App. filed May 16, 1917. Three-point type.

1,248,219. Igniter for Internal-Combustion Engines; Edmund G. Wayman, Swissvale, Pa. App. filed Jan. 31, 1916. Improvements.

1,248,246. Circuit Indicator; Walter E. Beede, New York City, N. Y. App. filed Jan. 17, 1914. Automobile.

1,248,255. Relating to Alternating-Current Dynamos; Max Breslauer, Hoppegarten, near Berlin, Germany. App. filed March 9, 1914. Adapted for use in connection with wireless telegraphy and other like purposes.

1,248,260. Meter Protective Device; James F. Burns, Philadelphia, Pa. App. filed Jan. 19, 1916. Meter may be adjusted in two planes at right angles to each other.

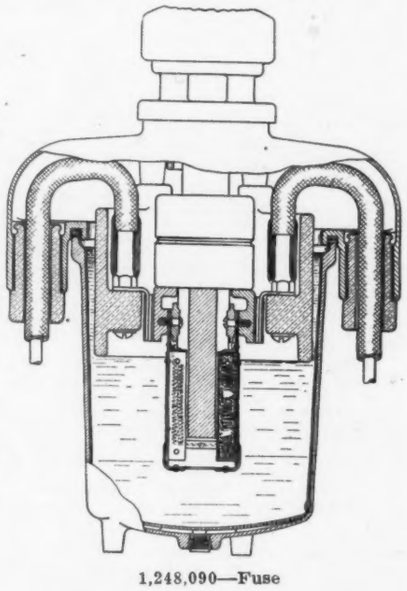
1,248,272. Electrical Connector; Samuel G. Crane, Toledo, Ohio. App. filed Jan. 27, 1915. Novel arrangement of multiple contacts and wiring connections.

1,248,344. Interlocking Device for Magnet Armatures; Frederick W. Kulicke, Philadelphia, Pa. App. filed April 14, 1916. Improvements.

1,248,380. Method of and Apparatus for Detecting the Presence of Ore Deposits in the Earth; Rupert Nelson, San Francisco, Cal. App. filed April 3, 1915. Improvements.

1,248,384. Electric Wall Switch; William J. Newton, Lynbrook, and Morris Goldberg, Brooklyn, N. Y. App. filed July 13, 1916. Means for securing the customary face plate to the switch-supporting means.

1,248,415. Switchboard; Hubert F. Krantz, Brooklyn, N. Y. App. filed April 11, 1916. Various elements thereof so arranged



1,248,090—Fuse

that a maximum number of switch-controlled connections may be safely made in a minimum of space and in a simple, efficient and practical manner.

1,248,421. Attachment Plug for Electric Wires; Charles F. Toren, Springfield, Mass. App. filed Sept. 13, 1916. Improved.

1,248,431. Self-Actuating Safety Panel; Hubert F. Krantz, Brooklyn, N. Y. App. filed Feb. 18, 1916. Door cannot be either opened or closed save when the switch blade is in open-circuit position such that an attempt to either open or close the door will throw the blade in set position.